

# ASHP 2012 Midyear Clinical Meeting

## Professional Poster Abstract

3-002

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Importance of safety stock in pharmacy inventory management with drug shortages

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**Purpose:** A national survey, conducted by the Institute for Safe Medication Practices (ISMP) showed that participating health care practitioners are very frustrated with ever-increasing number of drug shortages and many of them suggest that the problem has risen to the level of a national public health crisis. According to the ASHP guidelines on managing drug product shortages, health systems should refrain from stockpiling medications because the practice increases inventory cost and can exacerbate the problem by creating artificial shortages. Therefore attention should be given to develop a reasonably simple, scientifically sound method to determine at what level a safety stock should be kept for certain drugs in the environment with actual or anticipated shortages.

**Methods:** The pharmacy employs continuous-review system where the inventory level is monitored on continuous basis so that a new order is placed as soon as the inventory level drops to the reorder point. Reorder point, quantity and safety stock is calculated for constant as well as for interrupted supply conditions in order to minimize cost. Economic Order Quantity model with planned shortages is used for that purpose with proposition to consider a shortage cost as a premium paid for obtaining a drug from non-contracting supplier when contracting supplier experiences a shortage.

**Results:** A safety stock level calculated for interrupted supply conditions is somewhat higher than the one based on environment with stable supply, however maintaining this level ensures cost effectiveness and reduces, if not completely eliminates, the need for procurement of non-contract medications.

**Conclusion:** Maintaining newly calculated safety stock levels of the medications that are currently subject to allocations and shortages assures cost control, prevents unnecessary stockpiling of drugs and increases compliance of pharmacy procurement with purchasing policies.

**3-003**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Quantifying the impact of drug shortages at a university hospital

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**Purpose:** Drug shortages have been trending upwards in the number, duration and severity over the last several years. The increase in medication shortages is complex as well as multifaceted. Studies have shown that they are increasing cost to the healthcare system nationwide through increased cost of medication as well as through increased healthcare provider time devoted to determining alternative therapies and changing products. In addition, alternative medications can incur greater costs. The primary objective of this study is to quantify the increase in cost to UAB Hospital Pharmacy department caused by drug shortages by evaluating pharmacy personnel time spent addressing product shortages as well as evaluating the increased expense for medications that are in shortage and alternative agents used in their place.

**Methods:** A Microsoft Access database was used to prospectively collect pharmacy personnel time spent addressing product shortages. Changes in acquisition cost were measured by comparing the cost of medications or alternative medications during the periods of shortages to time periods prior to the shortage occurring.

**Results:** Over 1,200 hours were reported by pharmacy personnel in the management of drug shortages, which correlates to 97 hours per week. Of that, pharmacist time accounted for 76 percent of the total reported hours, resulting in 74 hours per week. The remaining 24 percent of time was spent by technicians for an average of 23 hours per week. The total changes in expenditures between first quarter 2011 and first quarter 2012 for the 84 drugs identified in the database was an increase of \$320,000.

**Conclusion:** Total expenditures for management of the shortages is an estimated \$395,000 at UAB Hospital. The personnel time reported resulted in \$75,000 in expenditures when calculated using average salary and benefits. Also, increases of \$320,000 in drug expenditures due to shortage occurred.

**3-004**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Reliability of an approach to resident selection interviews

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**Purpose:** Within candidate site visits, interviews are a standard instrument used for resident selection by residency programs. Though interviews are perceived as crucial by many programs, literature is skeptical of interview reliability and fairness. Reliability (ie, consistency) is critical to any sound evaluation. To address reliability and based on the OSCE multiple-station assessment method, multiple mini-interviews (MMI) have become a popular method during health-science program admissions. A common problem that is overcome by MMI is content specificity which necessitates multiple assessments towards sufficient reliability. In the literature, using a single case or interview seems poorly reliable, even with multiple interviewers. Determining factors that could improve interview consistency should be valuable in developing and implementing a fair interview process.

**Methods:** PGY1 residency candidate pools have increased steadily. With over 30 applicants, fewer PGY1 candidates could be invited to this program site. Each candidate participated in a half-day site visit. Along with the institution providing other program information and activities, candidates interviewed at 4 stations with each consisting of 2 interviewers. The 4 interviewer pairs included (a) current PGY1 residents, (b) pharmacy administrators, (c) hospital clinical staff preceptors, and (d) college faculty preceptors. Each interviewer rated each candidate on a single, global 4-point scale [excellent, above average, okay, concerns; with an additional, separate checkbox for do not rank]. Following interviews, ratings between interviewers at each station were averaged, and then totaled among the 4 stations (score out of 16). Candidates were sorted highest to lowest by these scores, and ASHPs Residency Match Program rankings were evaluated based on these scores. Subsequently, a Generalizability Theory analysis (G\_String 6.1.1 from [http://fhsperd.mcmaster.ca/g\\_string/index.html](http://fhsperd.mcmaster.ca/g_string/index.html)) was run to assess process reliability, and then to determine how reliability could be improved, if needed, by modifying variables and their influence on score variation using extrapolated D-studies. Additionally, among interviewer global rating scores, an intraclass correlation and Cronbachs alpha were computed to further describe inter-rater reliability. This study was IRB-approved.

**Results:** Twenty-four candidates were crossed with 4 stations while each station had 2 interviewers nested within. Relative contributions to score variation were candidates (74%; true variance), stations (3.4%), interviewers (2.5%; inter-rater), candidate-station interaction (13.5%; content specificity) and residual error (6.6%). The reliability (G-coefficient;  $G_c$ ) was 0.787 (and

while Gc has a range of 0.0-1.0, a common cutoff for admissions is  $>0.80$ ). By D-study extrapolation, a traditional 1-station interview with 2 interviewers would be  $G_c = 0.481$ , with 4 interviewers  $G_c = 0.526$  and 8 interviewers  $G_c = 0.552$ . Using multiple interview stations, an 8-station design with 2 interviewers at each station would elicit  $G_c = 0.881$ , and 8 stations of 1 interviewer would give  $G_c = 0.847$ . For the single rating scores among interviewers, inter-rater reliability by intraclass correlation was 0.832 while internal consistency by Cronbachs alpha was 0.868. Please note that both inter-rater reliability and internal consistency provide higher (inflated?) single variable reliability coefficients while Gc provides a lower multiple-variable value.

**Conclusion:** These results demonstrate that candidate-station error (ie, content specificity) played a substantial role in variation of candidate scores, and also a larger role than inter-rater reliability. Thus for improved reliability of resident selection interviews, increasing the number of interview stations seems preferred to more interviewers per station. While interviewers were not trained with the interview rubric used to determine global ratings in this case, the limited variability among raters suggested training may be minimally helpful towards improving overall evaluation reliability through improving inter-rater consistency.

**3-005**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Implementation of the serving leadership practice model in a community hospital inpatient pharmacy department

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**Purpose:** The Serving Leadership practice model gives priority to the needs of colleagues and working efficiently in a team environment. The Serving Leader was written by Ken Jennings and John Stahl-Wert, who shaped this idea to create successful leaders. It requires the leader to understand individuals strengths and promotes professional development. This process works on a five-tier pyramid to promote employee motivation and personal growth. Through the implementation of serving leadership principles, South Pointe Hospital department of pharmacy hopes to improve employee engagement, decentralize work flow, increase professional development, and retain leadership roles.

**Methods:** Implementation of the Serving Leader approach to South Pointe pharmacy management and staff, involved following the five primary actions of the serving leader pyramid: run to great purpose, upend the pyramid, raise the bar, blaze the trail, and build on strength. "Run to great purpose" was fulfilled by striving to do what is best for pharmacy employees. "Upend the pyramid" was accomplished by giving the pharmacist responsibilities outside the traditional scope, such as scheduling and productivity. Pharmacists were also decentralized on nursing floors to educate patients on medications and disease states. "Raising the bar" was satisfied by expecting Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores to be greater than 60%, lowering readmission rates in congestive heart failure patients, and raising employee engagement scores. "Blaze the trail" involved the pharmacists to become preceptors and educate students. "Building on strength" is promoted by giving Caregiver Awards to recognize employees for their work.

**Results:** Improvements were made at South Pointe Hospital pharmacy department in all five components of the Serving Leader practice model. The upended pyramid was started by giving pharmacists different responsibilities. There is a pharmacist responsible for creating the schedule, inputting productivity, and two pharmacists which are decentralized daily. The decentralized pharmacists are accountable for educating patients and serving their needs. Proving that the bar is raised results from having HCAHPS scores greater than 60%, and having them soar to the ninetieth percentile in March. The pharmacy department is among the top percentile for the hospital in employee engagement. In addition, all pharmacists have a leadership role in areas that interest them and are preceptors for students to aid in their education. South Pointe pharmacists have educated thirteen pharmacy students in 2012. Eight caregiver awards were

given to various pharmacists in the hospital to demonstrate their strength and dedication to the profession and the department.

**Conclusion:** Implementing Serving Leadership model in South Pointe pharmacy department was very successful. The pharmacy is able to recruit and retain their pharmacists, in addition to having high employee engagement scores. All pharmacists are leaders in the department and have grown in their professional careers.

**3-006**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** CMS reimbursement of drug waste: A quantitative analysis at one medical center

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**Purpose:** The Center for Medicare & Medicaid Services (CMS) has set forth regulations and guidance on billing for discarded drugs and biologicals. This allows institutional pharmacies to bill and obtain reimbursement for drug waste from single use vials not used completely and are themselves discarded. Prior to 2010 all medications at our institution, including infusions prepared from single dose vials, were billed on the actual amount dispensed. Therefore, any excess drug left over from a single use vial was not reimbursed. The purpose of this project was to identify specific high-cost drugs in single dose vials, and to develop a billing and documentation process for inpatient and outpatient areas for Medicare reimbursement.

**Methods:** Starting in 2011 a list of high-cost medications which utilized single dose vials, administered as an outpatient in a single oncology infusion center or as an inpatient in a tertiary care medical center, was identified. Twenty-five medications were identified for potential reimbursement. To pilot the program the top 11 high-cost items from this list were chosen. This list consisted of mostly monoclonal antibodies and chemotherapeutic agents. In order to document waste from these agents, the pharmacists in the oncology satellite would provide an extra label documenting the waste from the single dose vial. This label was then placed in the chart, and CMS would be billed for the entire single use vial. For inpatients, the waste was documented directly in the pharmacy order entry system, which after discharge becomes part of the permanent medical record. Pharmacists responsible for order entry in specific areas were trained on the process of how to document waste. Specific reminders on these 11 medications were also created in the pharmacy order entry system to prompt the pharmacists to record the waste.

**Results:** Revenue from reimbursement of drug waste with the 11 drugs chosen for the program totaled \$507,682 in 2011. Oxaliplatin and bevacizumab accounted for almost 70% of the total reimbursement. Lessons learned from this pilot project included the need for development of standardized order sets within the pharmacy order entry system to help pharmacists document waste, and modifying outpatient databases to automatically capture and document waste in the patients medical record.

**Conclusion:** Implementation of processes to consistently and accurately bill for drug waste utilizing single dose vials results in substantial reimbursement. Training of pharmacy staff on when and how to document waste is critical for accurate documentation and billing. Future directions include the need for modification of current pharmacy order entry systems and patient

dispensing processes according to workflow to help optimize CMS reimbursement of all drug waste from single dose vials.

**3-007**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Resident practice management project focusing on the implementation of a mobile medication system at a rural VA

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**Purpose:** An automated medication delivery system was purchased to improve patient safety and increase efficiency of both nursing and pharmacy staff at the Veterans Affairs Black Hills Health Care System (VA BHHCS). As the carts were due to arrive during the residents term, the successful implementation of this mobile medication system was assigned as part of the Practice Management rotation.

**Methods:** Prior to implementation of a mobile medication system (MMS) or smart cart, multiple interdisciplinary team meetings were held. The Resident was directed to determine who needed to be in attendance and included individuals from pharmacy, nursing, respiratory care computer technology, infection control and biomedical engineering. The resident was then accountable for arranging the meetings, creating and facilitating an agenda and providing subsequent minutes. Meetings focused originally on assuring the infrastructure from all affected departments was in place to accommodate these carts. Meetings also focused on the benefits that the carts would have on patient safety compared to the existing system, as well as, the increased efficiency of both nursing and pharmacy staff. In addition, individuals were encouraged to voice any concerns that could be addressed and overcome prior to cart implementation. All project activity was posted on an Action Tracking Log that was expected to be kept current. The manufacturer provided the actual training for nurse manager-appointed area superusers on how to use the carts.

**Results:** Implementation went well due to the groundwork laid by the Resident. Because these carts are light and easy to maneuver, it is easy for nursing to take the carts in and out of patient rooms as they complete their other patient care activities. At the time they are taking care of the patient, they are also able to determine the necessity and/or appropriateness of medications. This is determined based on discussion with the patient, vital signs and the availability of real-time laboratory results. Furthermore, nurses have immediate access to new medication orders or changes to previous orders which enhances patient safety and results in significantly fewer missed doses and returns. Patient specific drawers are only opened once patient identification is verified using their Bar Code Medication Administration (BCMA) wristband coupled with a medication order providing an advanced level of patient safety. The added benefit of face-to-face time with the patient enhances patient rapport and provides opportunity for medication-related education. In addition, because the carts are lighter-weight, height adjustable and more maneuverable than the old system they are more usable on a daily basis. Cart implementation started on April 24, 2012 with two carts in Respiratory Care. The area superuser, although

apprehensive due to a lack of computer knowledge, was trained in four hours, and able to teach others in this area how to use the cart within one day. To date, Respiratory Care has no concerns related to the carts, and speaks frequently to the fact that the efficiency of respiratory medication administration has improved 100 percent. Subsequently, implementation on the Community Living Center began on April 26, 2012, and involved the training of two superusers. This area realized the most noticeable improvement in medication safety and staff acceptance with the implementation of a total of 11 carts. Currently, reported issues revolve around nursing procedures versus cart capabilities. All users are fully trained to use the carts, with only one individual experiencing difficulties; plans are to access the specific user log to identify and resolve issues. Lastly, the implementation of five carts on the Medical/Surgical Ward occurred on May 2, 2012. This was the most challenging of the areas as there was a lack of technology savviness amongst staff. Training was provided to the area superuser and nurse manager who have successfully trained all but two users. Although this area realized an improvement in patient safety, the biggest gain was in nursing efficiency as these carts allow nurses to remotely interface with the main dispensing cabinets.

**Conclusion:** Implementation of a mobile medication system has had a positive impact on patient safety and has increased efficiency of both nursing and pharmacy staff concerning medication administration. Because of the time and effort that the Resident put into establishing the groundwork for cart execution, together with the positive relationship established with the interdisciplinary team, this was an extremely successful implementation and a great learning opportunity for a Practice Management project.

**3-008**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** A study of stress and coping strategies in Lebanese pharmacy students

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**Purpose:** Pharmacy students often experience an undue amount of stress, which can have negative academic, emotional, or health outcomes. It has many sources, including academics, personal situations, environment, time, and economic circumstances. One of the major factors that are aggravating stress is the issue of having advancements in technology and pharmaceutical research, which is increasing the amount of knowledge being delivered during the same amount of time. An evaluation of stress conditions of students, their causes, stress supplement use, and providing management techniques is the purpose of this study.

**Methods:** To determine the incidence and factors controlling stress in pharmacy students at various years of studying, a questionnaire on personal data and stress inducing factors was validated. Students were asked to fill the questionnaire about their general condition and causes of stress, which was transformed into a score to determine their level of stress. Different categories of stress supplements have been identified and included in the survey to assess their use among the students who need to cope with stress. The survey is composed of twenty multiple choice questions and required an average of twelve minutes to be filled.

**Results:** Survey data was analyzed based on 200 responses (31% male, 69% female). The age of candidates varied between 18 and 25 years old. The data revealed that 54% experience pressure due to assignments, exams, and heavy curriculum, 37% describe their condition as being tired and sleeping more or less than usual, 29% of students need assistance because of stress, 29% have been experiencing anhedonia, 26% have no time to exercise, 23% have gained or lost weight, and 21% feel that the expenses, tuition, and study materials are an economic burden. The scores showed that the students were classified into: 5% have no stress, 66% have low levels of stress, 28% have medium levels, and 1% has high levels. Moreover, one fourth of the respondents reported feeling depressed. When asked about the use of supplements to relieve stress, 14.6% are on vitamin C, 12.3% on magnesium and vitamin B6, and 8.2% are taking daily multivitamin/mineral tablets. As for the stress management methods, the students were provided with multiple techniques to ease their condition: creating a study environment, sleeping well, revising and continuous reading, managing time, planning effectively, and being optimistic.

**Conclusion:** Based on the survey results, most participants have had varying levels of stress. The prevalence of stress among pharmacy students should be acknowledged and tends to affect their

academic performance and aspects of health. Attempts should be taken into action to alleviate stress by proper guidance, recreational activities, and revised schedule of exams and courses. This project served as a good opportunity for pharmacy students to express their feelings and to guide the school of pharmacy to handle the situation.

**3-009**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Establishing a network pharmaceutical sourcing position

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**Purpose:** Our 7 hospital network was looking for additional ways to cut costs in the face of decreasing reimbursement from Medicare, Medicaid, and private payers. All departments were asked to contribute significant savings to the fiscal bottom-line. Pharmacy costs makeup approximately 15% of the total hospital budget, with 80% of the pharmacy budget associated with drug purchase costs of approximately \$40 million. Due to operational, regulatory, and personnel demands on each of the directors of pharmacy in the network, it is difficult for any of those individuals to coordinate and push cost-savings strategies across the network.

**Methods:** A proposal was made to fund a new position of network pharmaceutical sourcing manager. The position would provide leadership for pharmaceutical supply chain management throughout the network. Both cost-saving and revenue enhancement opportunities were identified prior to establishing the position. A return on investment of 4:1 dollars of savings/revenue to salary of the position was identified as the target goal. It was expected that savings would be found in several different ways, including contract management, vendor negotiation, formulary standardization, utilization improvement, patient assistance reimbursement, and therapeutic substitutions. The position would require the ability to drive change, leadership of people and resources, and the ability to foster collaboration among the network hospitals. This position was also strategically placed in the network hierarchy with other supply chain personal to collaborate with other sourcing projects outside of pharmacy across the spectrum of care.

**Results:** The position was funded and filled in February 2012. It reports directly to the VP of Supply Chain Management for the network. A network pharmacy expense team consisting of this position along with all the hospital pharmacy directors was organized and meets monthly. The network sourcing manager also meets monthly with the clinical coordinators from each respective hospital. To date, 32 different cost-savings initiatives along with 6 revenue enhancement projects have been identified. The total dollar value opportunity identified for the network is just under \$6 million. Tracking and progress regarding implementation of each initiative is monitored via a spreadsheet that is updated weekly and provided to each organizational financial and pharmacy leader.

**Conclusion:** The network pharmaceutical sourcing position has identified significant cost savings for the network, and has far exceeded the target return on investment of 4:1.

**3-010**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Wholesaler Conversion: Strategies for Success

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**Purpose:** The market for wholesaler contracting continues to evolve with continual benefits for hospitals and integrated networks. The Partners Healthcare System (PHS), a network of 9 hospitals and numerous other healthcare entities, representing approximately \$280 million in pharmaceutical purchases, felt that it was time to test the market. PHS utilized the same wholesaler for the past 25 years and had no way to validate the strength of the contract without conducting a Request for Proposal (RFP).

**Methods:** A committee, comprised of pharmacy directors, materials management contracting experts, finance representatives, Information technology representatives (PHS and Pharmacy), pharmacy buyers, blood bank and radiology representatives and pharmacy directors engaged in an evaluation over 12 months, and ultimately decided to change wholesalers. The savings were determined to be several million dollars over and above the existing contract and well worth the effort to change processes and purchasing systems in such a large network. In order to lend some objectivity and additional support to the process, PHS engaged the assistance of a consulting pharmacist from the Group Purchasing Organization of which PHS was a shareholder. An Implementation Team was established to track key areas of transition via 4 subcommittees Accounts Payable, Contract Management, Non- Pharmacy/Plasma and Biologic Purchasing/ Reimbursement and Technology. Each committee was co-chaired by the GPO consultant and a member of the PHS network. The Implementation Team met weekly in person or by telephone starting approximately 3 months before conversion and for a few weeks post conversion. The poster will cover the responsibilities of each committee and some of the challenges tackled. The new wholesaler provided PHS with an entire team of personnel throughout the transition and was well integrated into all of the meetings, the conference calls and on-site visits. The GPO consultant and the Vice President for the wholesaler for the region were co-chairs for the process. Several systems had to be tested prior to go-live. PHS wanted one invoice for the pharmaceutical plasma/biologics products but 2 invoices were determined to be what the wholesalers system was capable of providing. All prior and new wholesaler subaccounts had to be cross-mapped by account all the way to the standard journal entry point and then tested.

**Results:** Conversion occurred purposefully on Tuesday, 10/4/11 in order to allow the pharmacy directors and buyers to clear up any residual problems from the weekend. Deliveries were trialed by the new pharmaceutical delivery company several days in advance in order to enable the new drivers to understand their routes and the specific loading dock locations in order provide an uninterrupted flow of products. The last wholesaler order from the departing prime vendor was placed Monday night for the Tuesday delivery and the new wholesaler (first) order was placed Tuesday for a Wednesday delivery. The Implementation Team engaged in daily conference calls to address any issues or problems during the transition week to be able to establish an immediate

plan of correction. Besides the telephone conferences, all participants had complete access to key contacts at PHS, with the wholesaler and with the GPO consultant via email and face to face meetings. The wholesaler local representative was key in maintaining communications and in frequent visitations.

**Conclusion:** Key to the success of the project was a tracker tool that highlighted responsibilities and timelines and was used as the point of focus during conference calls in order to assure that the project was on track and on target. As the hospitals continue to evolve and add more entities i.e. physician office practices, clinics, additional challenges have arisen and their resolution will be described. The poster will display this tool along with other documents i.e. communications to pharmaceutical manufacturers, for participants to observe. The conversion process was successful due to extensive communications and commitment on the part of all participants to ensure success and most importantly, uninterrupted availability of pharmaceuticals for the patients served by PHS.

**3-012**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Developing a Post Graduate Year Two Health System Pharmacy Administration Residency Program

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**Purpose:** The design and implementation of a Post Graduate Year Two Health System Pharmacy Administration residency program at a private non-profit health system is described.

**Methods:** An environmental assessment was performed to identify internal and external factors influencing the climate for growth in the pharmacy training program at Virginia Mason Medical Center (VMMC). A systematic market analysis was then conducted to collect quantitative and qualitative data on competitors, collaborators, context and company skills to establish strategic direction, recruitment strategy and development of program foundational elements. Specific experience and activity ideas were generated via creativity exercises. In addition, personal interviews of other PGY2 residents and program directors along with a background literature search on pharmacy workforce, leadership demand, and program development were conducted.

**Results:** Foundational elements developed include program structure, core processes (learning experiences), and outcomes (goals, objectives) that satisfy both accreditation standards and departmental strategic plan. This PGY2 residency is designed to be a stand-alone program, not associated with a degree, school of pharmacy or requiring a two-year commitment. The program was designed to be delivered with primarily longitudinal learning experiences, involving both a combination of didactic and experiential activities. The longitudinal experiences include Quality, Service, Innovation and Technology, People, Operations and Leadership. Each experience has been cross-walked with ASHP required goals and objectives and is closely linked to the VMMC strategic plan pillars of Quality, Service, Innovation and People. The Innovation experience is unique to our program, in that the resident will participate and complete formal lean methodology training culminating in leading a Medical Center improvement event. Elective experiences, such as patient care, group purchasing organization exposure are also available. Delivery of the experiences occurs in our learning lab environment. The lab consists of a defined work team that the resident will directly supervise allowing them ample experience with managing people, budgets, projects and interact with a variety of other departments. The administrative resident will be an active member of the pharmacy department leadership team and is expected to adhere to the VMMC Leadership Compact. Each member of the leadership team has some role and influence on the performance and work of the learning lab environment.

**Conclusion:** The use of environmental and strategic analysis tools has allowed for the development of an innovative residency program that differs from other regional offerings. Developing a clear vision that aligns with the organization strategic plan allowed for a fluid program design and similarly, anticipated delivery. This focal point will also allow for continued assessment of program and incremental improvements.

**3-013**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Pharmacy residency program director approaches to assessing applicants' communication and interpersonal skills

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**Purpose:** Pharmacy residency applicants must position themselves well, given the increasingly competitive recruitment process. In addition to strengthening their application with leadership experience and a strong academic record, applicants must consider how communication skills and professional interactions influence their candidacy. The purpose of this study was to determine the value residency program directors (RPDs) place on and methods they use to assess applicant communication and interpersonal skills.

**Methods:** RPDs from a single state received an e-mail invitation to participate in an IRB exempt, pre-tested electronic survey in March of the 2012-2013 pharmacy residency match cycle. Participants characterized their candidate screening process according to eight application features and six interview features, and the corresponding dimensions (communication skills, interpersonal skills, knowledge base, and experience) of a residency applicant each feature evaluated. RPDs rated the importance (crucial, important, somewhat important, and not considered) of 14 methods by which applicants communicated with the program, and 3 means by which reference letters were obtained. Participants reported the approaches (formally evaluated, informally evaluated, evaluated based on performance extremes, or not evaluated) their program used to evaluate 12 application features or interactions with the applicant. Demographic data were collected from each RPD to allow for stratified analysis of the results. The application and interview features were ranked in an ordinal fashion by response rate for each dimension. To quantify the relative importance of communication methods and recommendation solicitation methods, a Likert scale (crucial=4, important=3, somewhat important=2, and not considered=1) was applied, allowing for analysis via descriptive statistics (mean plus/minus standard deviation). The application features and interactions were ranked in an ordinal fashion by response rate for each mode of assessment.

**Results:** Forty percent of invited RPDs participated in the study. Fourteen of the 19 respondents directed PGY1 programs. The applicants cover letter (100%), faculty member recommendation (74%), and preceptor recommendation (63%) were the application features most commonly used to assess communication skills. Recommendation letters from preceptors (90%) and faculty members (84%) were features most often utilized to evaluate interpersonal skills as well as knowledge base. As a gauge of pharmacy practice experience, the curriculum vitae (100%) was the most valuable source of information, followed by preceptor (79%) and employer (74%) recommendations. A meal between the candidate and preceptors/residents was the interview

feature most commonly used to evaluate communication skills (95%), interpersonal skills (90%), and experience (32%). The most important venue for communication between an applicant and RPD was the on-site interview (3.95 plus/minus 0.23) followed by student rotations (3.68 plus/minus 0.48), and employment at the residency site (3.47 plus/minus 0.90).

Recommendations solicited by the RPDs (3.42 plus/minus 0.69) were more important than those solicited by applicants (3.32 plus/minus 0.58) or unsolicited (3.21 plus/minus 0.85). Programs formally evaluated the interview (89%), recommendation letters (84%), cover letter (79%), and curriculum vitae (79%). Interactions that were most frequently informally evaluated were residency showcases (79%), communication following a showcase (74%) or interview (74%), and communication indicating interest in a program prior to a showcase or interview (63%).

**Conclusion:** A variety of application and interview features are used by residency programs, each intended to evaluate various dimensions of an applicant. Applicants should be aware that both informal interactions with RPDs and formal application and interview components can influence their standing. Understanding the importance of and process RPDs use to assess communication skills and interpersonal interactions should improve residency candidates to become more competitive residency prospects.

**3-014**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Under-reporting of interventions made by pharmacists in a community hospital setting

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**Purpose:** Pharmacists working in a health system make interventions on a daily basis, yet there is a risk that documentation is not representative of their true impact. As health care evolves, accurate documentation of the clinical benefit that pharmacists provide is important both in published literature and to pharmacy leadership advocating for resources. This project was undertaken to evaluate the gap between self-reported pharmacist intervention data and total audited interventions for medication reconciliation orders during the admission process.

**Methods:** Intervention documentation was compared to original medication reconciliation forms completed between March 13, 2012 and May 5, 2012. The data collected included the date and time the orders were faxed, the date the orders were reviewed, the number of medications ordered, the number of errors identified and whether nurse or physician contact was required. The criteria for a medication intervention included: unclear directions for use, inaccurate dose or route of administration, orders for inappropriate over-the-counter or herbal medications, presence of a drug interaction requiring a change in therapy or an order for a non-formulary medication without an approved auto-substitution. Pharmacist-initiated therapeutic substitutions were excluded.

**Results:** A total of 1,020 medication reconciliation forms containing 8,688 medication orders, were evaluated and compared to 903 data entries from 7,822 medication orders documented on intervention forms. Though pharmacists reported clinical review of 90 percent of the total orders received, only 37 percent of interventions and 30 percent of phone calls to nurses or physicians were documented. Incomplete medication reconciliation forms occurred at a rate of 21 percent based on self-report, yet audited data demonstrated that 54 percent of all forms were incomplete.

**Conclusion:** When comparing self-reported to actual interventions, pharmacists document fewer than 50 percent of their interventions. Advocating for additional pharmacy resources, it is important for pharmacy leadership and administrators to be aware of the conflicting priorities that pharmacists encounter, resulting in under-reported intervention statistics.

**3-015**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Incorporation of interview skills training into experiential student rotations

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**Purpose:** Pharmacy students are entering an increasingly competitive market for pharmacy internships, residency programs and entry-level positions. Traditionally, pharmacy practice experiences expose students to the operational and clinical functions of a pharmacy, but little time may be available for other practicalities of the real world, such as interviewing for a job. This project examines incorporating interview skills training into pharmacy practice experiential rotations.

**Methods:** Pharmacy students undergoing an advanced hospital practice experience (APPE), introductory pharmacy practice experience (IPPE), or internship at South Pointe hospital department of pharmacy were given an opportunity to participate in an interview skills training workshop. The workshop included a 30-minute mock interview with the preceptor for each student, a presentation given by the preceptor on behavioral-based interviewing and interview preparation tips, and one-on-one post-interview feedback for each participant. Students filled out a pre- and post- workshop self-assessment survey. The pre-workshop survey included questions about the students prior interview experience (number and types of positions the student has interviewed for), perception of availability of interview skills training at their college of pharmacy, and familiarity with behavioral-based interviewing and interview preparation. Post-workshop questions asked the students to re-assess their familiarity with behavioral-based interviewing and interview preparation.

**Results:** Six students completed the pre-workshop survey and four students completed the workshop and post-workshop survey in June 2012. Sixty seven percent and 33 percent of students reported having undergone 1-3 and 4-6 interviews, respectively. When broken down by type of position being interviewed for, 34 percent were pharmacy jobs, 33 percent college admissions, 19 percent non-pharmacy jobs, and 14 percent scholarships. With regards to prior interview training, 33 percent reported having interviewing skills covered as part of the college curriculum, 83 percent had workshops or courses offered by student or professional organizations, but only 50 percent reported participating in these workshops. When asked to self-assess their pre- and post- workshop familiarity with behavioral-based interviewing, Situation Task Action Result (STAR) model, and interview preparation on a scale of 1 (strongly agree) to 5 (strongly disagree), the average scores were 3.7, 4.2, and 2.3 for the pre- survey and 1, 1.3, and 1 for the post-survey, respectively. All workshop participants indicated that the workshop was useful and the preceptor feedback helped them understand how to better prepare for future interviews.

**Conclusion:** Pharmacy students have limited experience interviewing for professional pharmacy positions. Interview skills training and mock-interviews incorporated into pharmacy practice

experience rotations provides valuable feedback to the student, which he or she could not expect to receive in an actual interview.

**3-016**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Hospital Employee Prescription Costs May Be Reduced by Using a Transparent PBM

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**Purpose:** Prescription medication costs continue to increase and draw corresponding media attention. Although scrutiny of medication costs often involve the manufacturers, wholesalers and pharmacies, the pharmacy benefits management companies (PBMs) are not commonly evaluated. Given the heightened attention to transparency within the health care system, PBM transparency and evidence-based medicine therapeutic changes may provide cost savings to hospitals affording additional resources to fund medication therapy management (MTM) programs.

**Methods:** A descriptive analysis was conducted on two hospitals to evaluate if a highly transparent PBM that offers evidence-based medicine interventions for managing employee prescription claims offers enough cost savings to fund the launch of an MTM program. Two hospitals were chosen to evaluate based upon close proximity, interest in participation, and concern for rising prescription costs. Analysis included ingredient costs and evidence-based therapeutic interchange interventions. Average Wholesale Price (AWP), employer and employee contributions and manufacturer rebates were also evaluated. All patient-specific data was protected.

**Results:** A total cost savings of \$234,508 (44.6%) was projected for one hospital that generated 7,443 prescription claims. A total cost savings of \$24,149 (59.9%) was projected for a second hospital that generated 952 prescription claims. All prescription drug claims were evaluated over a two year period.

**Conclusion:** Hospitals that wish to fund MTM programs for their employees and dependents may be able to identify resources through possible PBM changes with their institution. Costs reductions associated with PBMs may not necessarily be sustained unless MTM programs are implemented to improve medication outcomes. MTM programs have typically been correlated with reduced medical claims costs.

**3-017**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Exposing wholesaler prime vendor contracts: Lessons learned by a diverse member network

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**Purpose:** To describe the negotiation process with pharmacy wholesalers in order to obtain best terms for cost of goods, service, technology, and group purchasing organization (GPO) relationship in a preferred distributor program (PDP).

**Methods:** The Northwest Pharmacy Council (NWPC) is a network of hospitals, ambulatory surgery centers, and clinics located in the Pacific Northwest that contract for pharmacy wholesaler services as a group. A committee of NWPC members convened and issued a request for information (RFI) to three wholesalers. Wholesalers presentations reviewed company offerings and responded to questions from the committee. Based on this information detailed request for proposal (RFP) was prepared and delivered to each wholesaler. Proposals from each wholesaler were reviewed with respect to cost of goods, service, technology, and GPO relationship. Wholesalers were asked for their best and final offer in a counter proposal. The committee prepared a presentation to members that compared the proposals on the domains of interest. Group members were asked to ratify the committee recommendation of wholesaler.

**Results:** Pricing transparency discrepancies exist between wholesalers, as do exclusions on discounted cost of goods. Wholesaler willingness to work with group contracted specialty pharmacy providers varied, which affected the cost of good model volumes. Pharmacy directors identified differences between wholesalers in conversion and retention incentives, ordering platforms, handheld technology availability and capabilities, access to product availability beyond the designated distribution center, return programs, delivery schedules and surcharges, customer service models, access to clinical and financial data analysis tools, data support to the GPO, and management of drug shortages. The committee presented results from the process that balanced cost of goods, service, technology, and GPO relationship to the membership. Membership ratified the selection of the wholesaler.

**Conclusion:** A robust RFI, RFP, and counter-proposal negotiation process was used to balance cost of goods, service, technology, and GPO relationship to achieve a new PDP agreement that benefits all group members.

**3-018**

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Development and implementation of objective performance measures for pharmacy technicians

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**Purpose:** For both new and seasoned managers, effective performance management requires a significant investment of time and energy to fairly evaluate employee performance. For many managers, this process involves solicited and unsolicited feedback as well as anecdotal observations to determine an overall performance rating. This subjective approach may result in employees feeling confused and dissatisfied as it may not accurately reflect their own views on performance and may lack the necessary information on how to improve. Implementation of technology in pharmacy has created new avenues to support broad based data collection to assist in quality and efficiency evaluation. This approach is especially effective for employees who perform technical functions, such as pharmacy technicians. The goal of this project was to incorporate data made available by technology into performance measures for pharmacy technicians that provide meaningful information for both performance ratings as well as improvement plans.

**Methods:** In April 2010, objective performance categories were developed and discussed with the pharmacy technician workforce. These categories included primary job functions of medication filling, medication delivery, and regulatory job requirements. Systems that supported data collection included pharmacy carousels, medication tracking software, automated dispensing cabinets, and a temperature log recording system. Following development, a pilot period was implemented from May 2010 to July 2010, to determine the appropriate performance thresholds. These thresholds were then directly applied to the hospitals performance rating system of exceeds, fully meets, meets most, and needs improvement. If a technician did not perform a function during a particular month, the performance score for that month was rated as not applicable. Starting in January 2011, objective performance measures and goals were implemented and monitored for the pilot work area with monthly updates from 1/2011 11/2011. In March of 2011, an additional measure was added to improve completion rates of medication expiration outdates performed by technicians at the automated dispensing cabinets.

**Results:** In January 2011, 66% (n=12) of employees scored fully meets or higher on medication filling, 69% (n=13) scored fully meets or higher on medication delivery time, 62% (n=13) scored fully meets or higher on compliance with medication delivery scans, and 58% (n=12) scored fully meets or higher on completion of temperature log recording. In March 2011, 100% (n=6) scored fully meets or higher on completion of medication expiration outdates. In November 2011, 100% (n=11) of employees scored fully meets or higher on medication filling, 83% (n=12)

scored fully meets or higher on medication delivery time, 100% (n=12) scored fully meets or higher on compliance with medication delivery scans, 100% (n=11) scored fully meets or higher on completion of temperature log recording, and 71% (n=7) scored fully meets or higher on completion of medication expiration outdates.

**Conclusion:** Implementation of technology driven performance measures is an objective method of job evaluation. Once established, employees can and will utilize this information to improve performance. Clearly defining job expectations and letting employees know what is expected resulted in improved performance in nearly all measured categories.

**3-019**

**Category:** Ambulatory Care

**Title:** Pharmacist interventions in a heart failure transitions clinic

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**Purpose:** Heart failure is the most common principal discharge diagnosis among Medicare beneficiaries in the United States. As part of healthcare reform, Centers for Medicare and Medicaid Services (CMS) will soon financially penalize institutions with heart failure readmission rates that are considered excessive. Numerous studies have shown that pharmacist involvement within a collaborative care setting reduces heart failure readmissions. This report describes interventions made by a pharmacist in an ambulatory, interdisciplinary transitions clinic aimed at reducing 30-day heart failure readmission rates in patients who were discharged from an acute care setting with a principal diagnosis of heart failure.

**Methods:** Pharmacist interventions, as part of an interdisciplinary team consisting of a Nurse Practitioner and Registered Nurse, were documented prospectively for a 6-month period between September 1, 2011 and February 29, 2012. Interventions were made post-discharge either during a clinic visit or via telephone and included medication adjustments (initiation, discontinuation, dose increase or decrease, or dosing pattern), identification of drug-drug/drug-disease interactions, adherence issues, lab abnormalities, adverse effects, medication errors, medication contraindications as well as cost savings opportunities.

**Results:** A total of 105 patients were seen in clinic and 77 telephone calls were made in the specified time period. One hundred and sixty eight medication adjustments were recommended, 127 of which were made in clinic, 55 of which were collaborative. Five of these recommendations were either declined or deferred by the patient or healthcare provider. Regarding medication safety issues, there were 32 drug interactions, 23 incidents of non-adherence, 44 lab abnormalities, 31 adverse effects, 20 medication errors, and 14 medication contraindications identified. There were also 4 cost savings interventions made.

**Conclusion:** This descriptive report supports that there are numerous interventions that can be identified and made by a pharmacist as part of an interdisciplinary team and that pharmacists play a key role in delivering optimal care to heart failure patients. There was an average of 1.8 medication-related interventions identified per patient encounter, when combining both clinic and telephonic encounters; the average was 2.4 interventions per clinic encounter compared to 1.1 interventions per telephonic encounter. This difference may be due to the nature of the telephonic encounters as most of the calls made were for follow up purposes. In contrast, most of the clinic encounters were initial evaluations. The majority of interventions recommended were accepted by both the patient and other healthcare providers on the team.

**3-020**

**Category:** Ambulatory Care

**Title:** Case report of a unique drug-drug interaction with an oral contraceptive and lamotrigine

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**Purpose:** This abstract and poster will: (1) describe a patient case needing an effective oral contraceptive while on lamotrigine therapy (2) discuss the unique drug-drug interaction with oral contraceptive use and lamotrigine and (3) discuss the options available to safely manage this drug-drug interaction. The patient is a 27-year old who was consulted to the Pharmacy clinic due to a unique drug-drug interaction that existed with oral contraceptive use and lamotrigine therapy. Her medications at that time included lamotrigine 100mg daily, divalproex SA 1000mg at bedtime, sertraline 100mg daily, and minocycline 100mg twice a day. Oral contraceptives commonly have a combination of both estrogen and progesterone. This drug-drug interaction presents a unique challenge because the estrogen component causes the blood levels of lamotrigine to be decreased by 50 percent (41-64 percent), and lamotrigine causes the level of progesterone to be decreased by 20 percent. This results in a bi-directional interaction which is extremely important to note. Studies have demonstrated that the estrogen component increases the clearance of lamotrigine by liver glucuronic acid conjugation; this could lead to sub therapeutic levels of lamotrigine. These pharmacokinetic studies also demonstrate an approximate 20 percent decrease in plasma progestin levels, and no effect on the estrogen component. Measurement of serum progesterone indicated that there was no hormonal evidence of ovulation, although measurement of serum follicle stimulating hormone, luteinizing hormone, and estradiol indicated that there was some loss of suppression of the hypothalamic-pituitary-ovarian axis. If a combination oral contraceptive is considered for this patient, a subsequent increase in lamotrigine is necessary in order to maintain therapeutic levels. The current literature recommends increasing the dose of lamotrigine by 50 percent in order to compensate for the liver induction. Another aspect of this drug interaction that needs to be considered is that combination contraceptives are typically taken for 21-24 days out of a 28 day menstrual cycle. As a result, this may significantly increase lamotrigine plasma levels during the placebo days. The effect of other hormonal contraceptive preparations such as Ortho-Evra patch, NuvaRing and Mirena intrauterine device (IUD) on the pharmacokinetics of lamotrigine has not been systematically evaluated; however, given that all these agents are hormone based, concerns discussed above are still present. Additionally, an injectable medroxyprogesterone could be an option as well but it would not be ideal. Given the results of the studies mentioned previously, the decrease in plasma progestin levels did not correlate to signs of ovulation; therefore, there is clinical data to support its use. The method that remains without risks of potential seizure or toxicity is the non-hormonal IUD such as a copper IUD or barrier methods such as condoms or

diaphragms. The available product in the United States for a copper IUD is ParaGard, indicated for intrauterine contraception for 1, 5 and 10 years but may be removed at anytime. Considering all of the above information, the Pharmacy Clinic recommended the best and safest option which was the insertion of a copper IUD. Institutional review board approval and informed consent were obtained for this case.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

**3-021**

**Category:** Ambulatory Care

**Title:** Effectiveness of gemfibrozil versus fish oil in lowering triglycerides in patients currently on background simvastatin therapy

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**Purpose:** Monotherapy with hydroxyl 3-methylglutaryl-coenzyme A reductase inhibitors (statins) is often insufficient to achieve lipid goals in patients with mixed dyslipidemia, thus necessitating combination therapy. In June 2011, the Food and Drug Administration announced changes to simvastatin product labeling including a contraindication with gemfibrozil. At that time, there were over 200 veterans at the Providence Veterans Affairs Medical Center (PVAMC) on the contraindicated combination needing alterations in their lipid management. Many of these patients were transitioned from gemfibrozil to fish oil (FO), because of the FOs triglyceride (TG) lowering efficacy and excellent safety profile. The objective of this pilot project was to assess the effectiveness of FO versus gemfibrozil in combination with simvastatin in the treatment of patients with mixed dyslipidemia.

**Methods:** The PVAMC IRB and RD committees approved this retrospective chart review. Data were collected from veterans on background simvastatin therapy, who were converted from gemfibrozil to FO treatment from June 1, 2001 to December 31, 2011. Patients 18 to 89 years of age with a diagnosis of hyperlipidemia and a history of and/or current elevated TGs were included if they had appropriate baseline and follow up lipid panels obtained. Patients with any contraindications to the study drugs or on omega-3-acid ethyl esters were excluded. The primary outcome was assessment of the mean percent change in TGs post transition to FO. Secondary outcomes included mean unit and percent change in various lipid subfractions. Student T tests, Fishers Exact test, and 95 percent confidence intervals were used to analyze the data. A p-value of less than 0.05 was defined as statistically significant.

**Results:** Charts from 248 patients were reviewed and 39 patients met inclusion and exclusion criteria. These patients were 48-84 years of age (mean 66.2 years plus/minus 10.3), 97 percent white, and 97 percent male. At follow-up the mean decrease in TGs was 12.5 percent. The mean decrease in LDL-C was 16.7 percent. Mean unit and percent changes for all lipid subfractions were comparable post transition from gemfibrozil to FO.

**Conclusion:** Use of simvastatin and gemfibrozil in combination is contraindicated and should be avoided. The mean decrease in TGs was 12.5 percent and in general lipid levels were comparable post transition from gemfibrozil to FO. As such, FO may be an acceptable alternative to gemfibrozil for patients on simvastatin with elevated TGs not at lipid goals.

**3-022**

**Category:** Ambulatory Care

**Title:** Utilization of oral anticoagulation selection criteria for patients in a warfarin clinic

**Primary Author:** Terri Marxen, Clinical pharmacist, The Valley Hospital, 223 N. Van Dien Ave, Ridgewood, NJ, 07450; Email: tmarxen@vallehealth.com

**Purpose:** The approval of new oral anticoagulants creates an opportunity to offer patients an alternative to traditional treatment with warfarin for atrial fibrillation. An evaluation of the new therapies reveals that there are both pros and cons to their use, emphasizing the importance of considering a variety of issues when evaluating a patient for recommendation to change from warfarin. In the Randomized evaluation of long term anticoagulation therapy (RE-LY) trial dabigatran demonstrated superiority in efficacy for stroke and systemic embolic events, had similar bleeding rates and less intra-cerebral hemorrhage than warfarin. A point of consideration in this trial is the time in therapeutic range for warfarin of 64% in RE-LY. While developing criteria, factors such as warfarin time in therapeutic range, patient age, compliance, dietary restrictions, drug interactions, renal function, gastrointestinal disorders, and financial circumstances must be taken into account. The objective of this study was to develop criteria for use of oral anticoagulation therapy and assess the patients with atrial fibrillation in a warfarin clinic.

**Methods:** All atrial fibrillation patients on warfarin for greater than two visits at the Anticoagulation Management Service between from January 1, 2011 December 31, 2011 were included in the study. Criteria for oral anticoagulation therapy were developed. Based on a sub-analysis of the individual time in therapeutic range (iTTR) of the RE-LY trial, a time in therapeutic range below 67% was identified as the evaluation point. Patients were further reviewed for candidacy for alternative oral anticoagulation therapy based on the developed criteria and review of specific circumstances leading to an out of range INR.

**Results:** Approximately 30% of patients had an individual time in therapeutic range below 67%. Reasons patients were out of range included inconsistent diet, compliance, stopped doses for procedures, weight loss, alcohol use, drug interactions and worsening heart failure. Of the patients with an iTTR less than 67%, 20% met the criteria to switch to an alternative agent. Five of nine patients switched to dabigatran changed back to warfarin for a variety of reasons including, bleeding and gastrointestinal side effects.

**Conclusion:** The time in therapeutic range for warfarin is a key indicator when evaluating the potential impact on mortality and should be incorporated in the criteria when considering switching someone to one of the new oral anticoagulation therapies. The development of criteria helps identify possible candidates for alternative oral anticoagulation therapy, but recommendations must be individualized based on specific patient circumstances.

**3-023**

**Category:** Ambulatory Care

**Title:** Impact of clinical pharmacists' recommendations on a proton pump inhibitor taper protocol in an ambulatory care practice

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**Purpose:** Overutilization of proton pump inhibitors (PPIs) has led to the implementation of an initiative at Atrius Health that limits unnecessary use of chronic PPIs and promotes cost-effective health care. The aim of this study is to determine the impact of clinical pharmacists' recommendations provided to clinicians to decrease unnecessary long term PPI use in patients who may not require chronic therapy.

**Methods:** The research study protocol was approved by the Massachusetts College of Pharmacy and Health Sciences Institutional Review Board. Patient data from the Atrius Health electronic medical record system was used to identify eligible candidates. Patients with any PPI prescription containing 3 or more refills written by their primary provider at least 5 months prior to an upcoming appointment with their primary provider were classified as chronic users and included in this study. Patients excluded were those with documentation of Zollinger-Ellison syndrome, Barretts esophagus, esophageal stricture, eosinophilic esophagitis, Schatzki's ring, history of esophageal dilation, history of bariatric surgery, current gastrointestinal ulceration, current H. pylori treatment, chronic oral steroid use (more than 1 refill in past 5 months), chronic NSAID use (more than 2 refills in past year), a gastroenterologist office visit within the past 12 months or upcoming 3 months, or age less than 18 or greater than 70. Clinical pharmacists electronically sent recommendations for PPI tapers to clinicians the day before each patient's appointment, during which the clinician may have initiated the PPI taper. Using insurance claims data, an average pill per month (PPM) count for the 5 months prior to the initiation of the PPI taper recommendation was calculated and compared to the average PPM count 5 months after initiation of the taper. PPM count was calculated by dividing the total number of pills a patient receives by the total number of days in that period, multiplied by 30. The primary outcome for the study was the change in average PPM count from baseline to follow-up. Secondary outcomes included change in total annualized PPI costs to the organization, proportion of patients who began the taper protocol, and whether baseline characteristics were predictors of response.

**Results:** Average PPM count decreased by 8.7 pills, from 25.6 (95 percent CI, 23.1 percent to 28.1 percent) at baseline to 16.9 (95 percent CI, 14.3 percent to 19.5 percent) at follow-up (p less than 0.001). For the 117 patients included in the study, there was an annualized PPI cost reduction of 24,674 dollars. 37.6 percent (44/117) of pharmacist-recommended tapers were

enacted upon by providers at the patient visit. No baseline patient characteristics were found to be predictors of successful taper response.

**Conclusion:** Clinical pharmacist intervention can decrease unnecessary PPI use in the primary care setting and promote cost-effective health care.

**3-024**

**Category:** Ambulatory Care

**Title:** Case report of dysgeusia secondary to metformin therapy

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**Purpose:** This abstract and poster will: (1) describe a patient case of dysgeusia secondary to metformin therapy and (2) discuss the prevalence of this adverse effect. The patient is a 79-year-old male who experienced dysgeusia while maintained on metformin therapy. The patient's past medical history includes: type 2 diabetes mellitus, hypertension, dyslipidemia, iron deficiency anemia, gastritis, and impotence. His medications at the time of his adverse effect included metformin 1000mg twice a day, glipizide 2.5mg, lisinopril 40mg, simvastatin 40mg, aspirin 81mg, docusate 100mg, and ferrous sulfate 325mg once daily. Patient was initiated on metformin therapy in August of 2011 and was slowly titrated and maintained on the clinical max dose of 1000mg twice daily. His A1C was 7.5% at that time and it was determined that a low dose of glipizide be initiated to further reduce the patient's A1C. This addition resulted in an A1C of 7% after 3 months. The patient presented four months later and reported he was having difficulty tasting any of his food. Patient stated he was extremely unhappy as he could not enjoy his food and would like for this problem to be resolved. At that time, it was decided to have the patient discontinue metformin therapy to determine if it was the cause as it has been linked to taste alterations; specifically a metallic taste. Almost 2 weeks after discontinuing metformin the patient reported that his loss of taste had resolved completely. The interaction resulted in a score of a 4 on the Naranjo nomogram, indicating that metformin could be the possible cause of the dysgeusia. The package insert of metformin claims that there is only a one to five percent chance that taste disturbances will occur in patients using metformin. The dysgeusia that is usually prevalent is related to a temporary unpleasant metallic taste in the mouth. However, there have rarely been instances where temporary loss of taste has resulted while on metformin in the literature. An extensive literature search only revealed one possible adverse drug reaction in which a patient experienced an altered sense of taste lasting four weeks. The poster will also discuss how the patient was managed following discontinuation of metformin therapy. Institutional review board approval and informed consent were obtained for this case.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

**3-025**

**Category:** Ambulatory Care

**Title:** Impact of group diabetes education classes on diabetes knowledge, program satisfaction and clinical parameters

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**Purpose:** A pharmacist-managed diabetes self-management education (DSME) program was developed at our institution. Referred patients initially attend two core group classes which cover seven key topics in DSME. Pharmacist educators follow-up with each patient via telephone within 2 weeks of the second class. The objectives of this study were to assess the effectiveness of the program by comparing baseline diabetes knowledge scores to scores after completion of the classes, assessing patient satisfaction of the program, and measuring effect on A1c at 3 months compared to baseline.

**Methods:** This was a prospective cohort study. Inclusion criteria were English-speaking patients 18 years or older with diabetes or pre-diabetes who were referred to the DSME program. A validated thirteen-item multiple choice diabetes knowledge survey was distributed at the start of the first class and subjects were given 10 minutes to complete the survey. The same knowledge survey and a satisfaction survey were given to all subjects at the end of the second class. The satisfaction survey consisted of a seven item survey scored using a Likert scale. A1c of each participant was recorded at baseline and 3 months after the 2nd class, if available. Descriptive statistics was calculated for all variables. Frequency distributions were used to describe categorical variables and means, standard deviations, and ranges were used for continuous variables. Paired T-tests were used to examine the differences in the pre vs. post knowledge scores.

**Results:** Forty three patients met inclusion criteria and consented to the study. The mean age of study subjects was 53.8 years, and 49% were male. 62.3% of the study subjects were Caucasian and 26% were Hispanic. The average knowledge scores for pre and post- knowledge surveys were reported as 10.09 and 10.71 out of 13, respectively ( $t=1.85$ ;  $p=0.07$ ). While no individual question response showed a statistical significance between baseline and the post-survey score, questions related to nutrition, hypoglycemia management, and complications of diabetes had the lowest overall scores at both baseline and in the post-knowledge survey. Out of thirty-one completed satisfaction surveys thirty subjects (96.7%) strongly agreed or agreed that classes met their expectation, the topics were presented clearly, teaching material provided were useful, and that they felt more comfortable in self-managing their diabetes after completing the two classes.

The average baseline A1c in our study population was 8.4%. Seven subjects A1c results were available 3 months after completion of the second class. Of these, the average A1c at 3 months was 7.9%, which was not statistically significant from baseline ( $t=2.1$ ;  $p=0.08$ ).

**Conclusion:** Our study showed high baseline diabetes knowledge scores in our subjects using the survey instrument, which did not improve significantly after completion of the group classes. Patients were highly satisfied with the classes and there was a trend of reduced A1c at 3 months compared to baseline in patients in whom A1c was available at 3 month follow-up. Overall, this study provided support that the DSME program was effective in meeting its goals and provided feedback to the educators on diabetes topics that need further emphasis.

**3-026**

**Category:** Ambulatory Care

**Title:** Impact of pharmacist involvement on chronic obstructive pulmonary disease management in patient aligned care teams

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**Purpose:** Chronic obstructive pulmonary disease (COPD) is a preventable and treatable disease, although mortality rates have steadily increased over recent years. Research has shown that COPD disease management programs can significantly decrease hospitalizations and emergency visits, therefore, reducing the health care burden. The incidence of COPD at the Veterans Affairs (VA) of Nebraska-Western Iowa is widespread and significantly impacts health care costs. In February 2011, a pharmacist managed COPD clinic was implemented at the Omaha VA as part of a residency research project.

**Methods:** The goal of the COPD clinic was to optimize medication therapy according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines by providing medication therapy recommendations to primary care clinicians. An analysis of the clinical recommendations was completed to determine physician acceptance and the need for a pharmacist guided COPD clinic. Patients were seen by the pharmacist in conjunction with scheduled primary care appointments. Clinical interventions conducted by the pharmacist included a review of the patients medication regimen and education on COPD, which was developed by the American College of Chest Physicians and the Chest Foundation. Patients also demonstrated knowledge of proper inhaler technique during the interview. Data collected included: COPD stage, the patient's understanding of COPD and medications, current medications to treat COPD compared to standard of practice, and whether COPD treatment was optimized. Additionally, information regarding vaccination records and tobacco usage was collected.

**Results:** Eighteen patients participated in the COPD clinic. All patients were male, ranging in age from 51 to 83 years old. Sixteen patients (89 percent) were Caucasian, and 2 (11 percent) were African American. The stage of COPD was based on 2011 guidelines and varied among patients: mild (n equals 2), moderate (n equals 9), severe (n equals 3), and very severe (n equals 1). Stage was not classified in four patients due to lack of pulmonary function tests (PFTs). Of the 31 recommendations that were made, 25 were accepted and 6 were denied. Recommendations that were denied included medication discontinuation, addition of medication(s), and obtaining PFTs. Prior to the pharmacists interventions, medication regimens

of 12 patients did not meet the standard of care based on the GOLD guidelines. Pharmacist's recommendations that were accepted resulted in optimization of COPD therapy for 100 percent of patients that were considered to have suboptimal therapy prior to intervention, regardless of COPD stage.

**Conclusion:** COPD is often undertreated despite availability of evidence-based guidelines. Medication selection, patient education, and adherence to regimen are all very important aspects for patients with COPD. Despite the challenges that exist, pharmacists are well positioned to positively impact COPD management by contributing to disease management. Pharmacist guided COPD clinics have the potential to provide substantial opportunity for improved patient survival and quality of life in the management of COPD.

3-027

**Category:** Ambulatory Care

**Title:** Effects of insulin injection site on short-term glycemic control in adult patients with type 2 diabetes mellitus: a prospective clinical case series

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**Purpose:** The abdomen is commonly accepted as the most rapid and consistent subcutaneous location for insulin injection; however, some patients may prefer injecting in other sites. While previous research has found differing insulin pharmacokinetics based on injection site, the clinical impact of these differences in patients with type 2 diabetes has not been quantified. The purpose of this exploratory study was to determine if changing the site of insulin injection from the abdomen to another approved site would affect short-term glycemic control in patients with type 2 diabetes.

**Methods:** The institutional review board approved this exploratory crossover study. Patients 18-85 years of age with confirmed type 2 diabetes for at least 12 months, an A1C between 6.5% and 9%, and treated with a stable dose of insulin for at least 30 days were enrolled following informed consent. Patients were instructed to inject insulin into the abdomen for the first 14 days of the study and into either the thigh or upper arm for the second 14 days. Insulin dosage was held constant throughout the 28-day duration of the study unless a critical change in dose was required. The primary outcome measure was an absolute change in mean blood glucose between subcutaneous injection sites (i.e., abdomen vs. thigh or upper arm). A clinically relevant difference in mean blood glucose was defined as greater than or equal to 15 mg/dL. The secondary outcome was a measure of patients' self-reported preference between injection sites, an assessment of ease of administration and pain.

**Results:** Nine patients successfully completed the research protocol. The absolute mean difference +/- SD in daily blood glucose between the abdomen and any other study injection site (i.e., upper arm or thigh) was 23.6 +/- 19.8 mg/dL (n=9) with a range of -51.0 to 46.9 mg/dL. The absolute mean differences between the abdomen vs. upper arm and abdomen vs. thigh were 39.5 +/- 11.3 (n=3) and 15.6 +/- 18.7 mg/dL (n=6), respectively. Zero patients experienced severe adverse effects, required acute medical care, or experienced any other adverse event while enrolled. Seventy-eight percent of patients considered the abdomen to be the most convenient and easy to use insulin injection site. There was no consensus in regards to which injection site was most painful.

**Conclusion:** Erratic changes in mean blood glucose were observed when changing the subcutaneous injection of insulin from the abdomen to either the upper arm or thigh in patients with type 2 diabetes. Based on these findings, we cannot definitively conclude how blood

glucoses will change when altering insulin administration sites. Clinicians should be conscious of these inconsistent results and take site administration into account when evaluating insulin efficacy.

**3-028**

**Category:** Ambulatory Care

**Title:** Delivering culturally appropriate care to optimize medication use in the elderly

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**Purpose:** To measure the effectiveness of delivering culturally and linguistically appropriate medication therapy management (MTM) services provided by pharmacists and community health workers (CHWs), trained to use telemedicine, to elderly Cambodian Americans.

**Methods:** The institutional review board approved this evaluation of a new clinical service. Community-dwelling residents age 50 and over, with the presence of at least one chronic condition and three chronic medications, had multiple MTM visits with credentialed pharmacists and CHWs over a 6-9 month period. Face-to-face encounters occurred with patients in Connecticut, while patients in California had a CHW with them and the pharmacist linked via high-definition videoconference link. Patients were screened at the time of their first and last visit for medication adherence behavior with the Modified Morisky Survey (MMS), depression with the Hopkins Systems Checklist, and medication beliefs with the Beliefs about Medication Questionnaire (BMQ). Medication related problems (MRPs) identified and resolved, therapy goals achieved, and total health avoidance costs were measured for the time period of the project. A snowball survey of community-dwelling Cambodian Americans was used to assess hospital usage comparing residents receiving MTM services. All data are de-identified and analyzed using appropriate statistical methods.

**Results:** A total of 627 patients were screened, 282 in Connecticut (CT), 345 in California (CA). A total of 96 eligible patients agreed to participate in the project (53 in CT, 43 in CA). A total of 217 patient encounters took place, an average of 2.8 visits/patient in CT, and 1.6 visits/patient in CA. The average number of medications and conditions/patient was 10.3 and 6.6, respectively. There was no significant difference between locations. A total of 604 MRPs were identified (6.3/patient), and 93% were resolved during the study period. The majority of MRPs (81%) were attributed to problems with medication indication, effectiveness, and safety, and adherence problems accounted for 19% of MRPs. Overall, the percentage of patients therapy goals achieved increased from 69% to 93% after MTM services were provided. There was significant improvement in adherence behavior ( $p=0.027$ ), depression screening ( $p=0.022$ ), and of inappropriate medication use (34.5% reduction) from initial to final encounter. Comparing the MMS to BMQ survey, more patients with low adherence had negative health beliefs than high adherers ( $p=0.015$ ), and there was a significant correlation between low adherence and how patients felt in general about medicines and how prescribers use medicine ( $p<0.001$ ). Over 80% of patients felt their medications were a necessity and that they were unable to cope without

them. Total health avoidance costs were \$291,114 (\$3032/patient), and exceeded the cost of providing the service by a factor of 5.6 to 1. Results of a matched control survey of 140 Cambodian Americans revealed that patients who did not receive MTM services had 1.75 times more hospital visits, 4.7 times more hospital days, and 1.5 times more emergency department visits than those patients who received MTM services during the same time period. An outcome comparison of face-to-face versus videoconference care revealed mixed results, primarily attributable to technology and social determinant variations that resulted in disparate encounter totals in the two service areas.

**Conclusion:** Pharmacists, when working with Cambodian American CHWs, can provide culturally and linguistically appropriate MTM that can improve patient medication outcomes and reduce total healthcare costs. The application of new technologies allows for the provision of MTM to be available to high risk isolated patient populations. These findings are compatible with current health care delivery reforms, especially the patient-centered medical home.

3-029

**Category:** Ambulatory Care

**Title:** Adherence rates and outcomes of patients prescribed dabigatran at a Veterans Affairs medical center

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**Purpose:** More than 95% of patients were adherent to taking dabigatran (i.e., had a medication possession ratio or  $MPR \geq 80\%$ ) in the 2009 landmark RE-LY trial, which demonstrated that dabigatran was more effective than warfarin for stroke prevention in non-valvular atrial fibrillation (NVAF). Dabigatran was first made available in February 2011 to Veterans Affairs (VA) patients as a non-formulary agent. In October 2011, Veterans Affairs Palo Alto Health Care System (VAPAHCS) added dabigatran to its formulary but required specific monitoring provided by ambulatory care pharmacists in the Anticoagulation Clinic (ACC) at 2 weeks, 1 month, and 3 months. Thus, in order to achieve similar outcomes, patients must have an  $MPR \geq 80\%$  as reported in the RE-LY trial.

**Methods:** This was a retrospective study comparing outcomes of patients who were prescribed dabigatran from 2/28/2011 to 10/25/2011 (usual care, UC, N=48) and 10/26/2011 to 3/14/2012 (ACC, N=20) after a 3-month follow-up. Initial dabigatran therapy had to have been prescribed through VAPAHCS for NVAF during the study period, and only patients prescribed a twice-daily dosing of dabigatran were included. Major exclusion criteria were inaccurate start date as documented in chart notes, no  $MPR$  at 3 months, new start on dabigatran (i.e., had not yet completed 3 months of follow-up), and discontinuation of therapy, transfer of prescription to an outside facility, or crossover to the other study group within 3 months. Primary endpoint was mean  $MPR$  at 3 months. Secondary endpoint was the incidence of bleeds, strokes, and venous thromboembolism. An interim safety analysis was conducted monthly starting 11/7/2011, in which providers whose patients had  $MPRs < 80\%$  were contacted and informed to counsel the patient(s) on adherence.

**Results:** Significantly more UC patients lacked baseline labs compared to ACC ( $p=0.02$ ). Although UC had more nonadherent patients versus ACC at 3 months (25% vs. 10%, respectively), this was not statistically significant ( $p=0.16$ ). For the primary outcome, both groups had a mean  $MPR \geq 80\%$  at 3 months, but ACC had a slightly higher value (88.3% vs. 93.1%). For the secondary outcome, both groups had similar safety and efficacy outcomes with one major gastrointestinal bleed in UC and no other outcome events in either group. Interventions were made on behalf of 6 UC patients as part of the interim safety analysis.

**Conclusion:** Although findings suggest that real-world adherence to dabigatran at 3 months may be similar to that of the RE-LY trial, the pharmacist follow-up (ACC) group was associated with a greater percentage of adherent patients, slightly higher MPR at 3 months, and better baseline lab monitoring compared to UC. While benefits of closer follow-up by ACC pharmacists within the first 3 months of therapy are unclear, adherence monitoring and education by pharmacists may be needed for some patients in order to keep  $MPR \geq 80\%$ . The clinical significance of these findings needs to be determined in larger, long-term trials utilizing comparably-sized cohorts.

**3-030**

**Category:** Ambulatory Care

**Title:** Evaluation of primary care provider pharmacist run shared medical appointments for patients with diabetes

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**Purpose:** Approximately 8.3 percent of the United States population has diabetes, and the prevalence is increasing. Shared Medical Appointments (SMAs) are a possible way to increase the efficiency of primary care providers (PCPs) in the treatment of chronic disease states such as diabetes. The purpose of this study was to describe how PCP-pharmacist-run SMAs are conducted at the San Francisco Veterans Affairs Medical Center (SFVAMC) and to assess the effectiveness and efficiency of these SMAs in the management of chronic disease states.

**Methods:** The following data was collected through a retrospective chart review of all patients who participated in PCP-pharmacist-run SMAs between November 1, 2010 and November 31, 2011 at SFVAMC: patient baseline characteristics, laboratory values before, during and after SMAs, medication changes made during SMAs, healthcare maintenance activities performed during SMAs, provider time spent in SMAs, appointments outside of SMAs, emergency department visits, and general SMA characteristics. The primary outcome was to assess the number of patients who have met target values of diabetes control by the end of the study period including hemoglobin A1c (A1c), blood pressure (BP), and low density lipoprotein cholesterol (LDL). Secondary outcomes were to determine the percent change in A1c, BP and LDL before and after SMA participation, to compare the number of emergency room (ER) visits and hospital admissions related to DM/BP/lipids prior to and during SMA participation, and to compare time spent in SMAs to individual 30 minute one-on-one visits. Descriptive statistics were used to report the baseline characteristics of the study patients, the change in A1c, BP, LDL, the difference in number of ER visits/hospital admissions before and after participating in SMAs, and medication changes made during the SMAs. The number of ER visits/hospital admissions during the period of time the patients participated in the SMAs was compared to the number of ER visits/hospital admissions in the same amount of time prior to the patient joining the SMA.

**Results:** Eleven groups were established during the study period. Each group held 5.7 SMAs (range equals 1 to 21), was run for a duration of 6.9 months (range equals 1 to 12.5) and had 4.4 patients (range equals 1 to 6) on average. A total of 79 patients attended SMAs, although 30 of them attended only one SMA during the study period. Of the remaining 49 patients, 11 (23 percent), 17 (35 percent), and 4 (8 percent) met their target goals for A1c, BP and LDL respectively. A1c decreased 0.8 percent, systolic BP decreased 9 mmHg, diastolic BP decreased 4 mmHg and LDL increased 0.2 mg/dL. There were a total of seven ER visits/hospitalizations

during SMA participation and seven prior to SMA participation. Each provider (PCP and pharmacist) spent an average of 41 minutes per patient in SMAs (median equals 30 minutes, range equals 12.9 to 150 minutes).

**Conclusion:** SMAs at the SFVAMC resulted in a minority of patients achieving A1c, BP and LDL goals and modest decreases in A1c and BP. ER visits/hospitalizations did not change. These SMAs do not currently save time compared to traditional one-on-one office visits.

**3-031**

**Category:** Ambulatory Care

**Title:** Assessment of the use of clopidogrel associated with gastroprotective medications in outpatients

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**Purpose:** Check the progress of hospitalization and death of the patients that use clopidogrel associated with omeprazole and the patients that do not.

**Methods:** A retrospective cohort was conducted between January 2007 and November 2009 to evaluate patients that were using clopidogrel in association or not with omeprazole.

**Results:** The study included 2823 patients. Of these patients, 36% were female and 64% were male, the mean age was 63 years. Regarding the association of drugs for gastric protection, omeprazole was prescribed to 45%, ranitidine for 9%, while 46% of patients were not receiving gastroprotective medication. As for the analysis by groups, 35.5% of the omeprazole group was hospitalized after starting treatment with clopidogrel, compared with 25.7% in the group without omeprazole. In evaluating the deaths among patients using clopidogrel in the study period, we found the occurrence of 36 deaths, 22 in the omeprazole group and 14 in the other group.

**Conclusion:** In our study, we did not evaluate the clinical status of the patients and the rates of reinfarction. And, as our study data showed, there are not any statistically differences between the groups that used clopidogrel associated with omeprazole, with ranitidine or that did not use any gastroprotective medication.

3-032

**Category:** Ambulatory Care

**Title:** Dabigatran Etextilate: Prescribing Practice, Safety, Adherence, and Patient Satisfaction in Ambulatory Patients

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**Purpose:** Dabigatran Etextilate is a direct thrombin inhibitor recently approved in Canada for the prevention of stroke in patients with atrial fibrillation. As a newly approved drug, there is little experience with its use and much to be learned from real world experiences of patients. To gain insight into the perceptions and experiences of patients prescribed dabigatran .

**Methods:** A qualitative study conducted at Sunnybrook Health Sciences Centre using semi-structured telephone and face-to-face interviews. Patients identified to be taking dabigatran who were willing to participate in a brief interview were enrolled and interviewed from January 2012 to May 2012. A total of 31 patients were enrolled and 23 patients or caregivers were able to be contacted to complete an interview. The interviews were recorded, transcribed and coded for themes.

**Results:** Patients discussed concerns regarding the cost of dabigatran and for the ten patients without insurance, they found it to be unaffordable. There were numerous concerns regarding the lack of a reversal agent and commercially available monitoring test for dabigatran. There were five patients who reported to have experienced an adverse event while on dabigatran. Despite these limitations, 70% patients who were on a prior anticoagulant, stated that they preferred dabigatran over other anticoagulants. Many patients were improperly storing their medications; nine patients pre-filled their dosettes and five patients stored their medication in an area of extreme temperature or humidity which can affect the stability of the medication. There were also difficulties in administration relating to ability to remove the capsule from the manufacturers packaging and swallowing the large capsule whole.

**Conclusion:** This study reinforces the need of pharmacists to assess patients prescribed dabigatran therapy both at initiation and follow up on cost barriers, proper storage, administration, and adverse effects to ensure the drug is being used optimally.

**3-033**

**Category:** Ambulatory Care

**Title:** Evaluation of colchicine therapy using facility-approved restrictions at VA Central Iowa Healthcare System

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**Purpose:** In 2009, the FDA approved a new single agent colchicine product for the prevention and treatment of acute gout flares and for the management of familial Mediterranean fever. During the drug application review of Colcrys (colchicine), the FDA highlighted two issues: (1) lower doses of colchicine can be used for treating acute gout flares and (2) life-threatening and fatal colchicine-related toxicity can occur with usual doses of colchicine in some patients. Patients with certain risk factors including drug-drug interactions, impaired renal or hepatic function and age (greater than 65 years) are at greatest risk. With approval of brand Colcrys (colchicine), generic manufacturers of colchicine were no longer allowed to produce this product and cost of colchicine rose dramatically. An initial review of patients prescribed more than 300 tablets in one year or on chronic daily colchicine in the absence of a urate lowering drug was completed by a clinical pharmacist. Following this initial review, VA Central Iowa Healthcare System approved facility restrictions consistent with FDA guidance to encourage safe and appropriate use of colchicine therapy. These recommendations include guidance for acute and chronic colchicine therapy as well as urate-lowering drugs for gout management. Quantity and refill limitations were approved for acute and chronic colchicine use. Non-formulary review is required for chronic colchicine therapy.

**Methods:** After facility restrictions for colchicine were approved and implemented, providers were given a list of patient with active colchicine orders. Providers had the option of independent review or clinical pharmacist review of colchicine therapy. For those providers who elected to have clinical pharmacist review, chart review with patient interview as appropriate was completed. Patients were interviewed regarding medication use, possible adverse events, symptoms, and success of therapy. Clinical recommendations were sent back to the provider upon completion review by the clinical pharmacist. Of the ninety-eight patients who were identified with active colchicine orders, clinical pharmacists completed 90 of those reviews.

**Results:** Of the 90 patients reviewed by clinical pharmacists, 41 patients were converted to an acute flare colchicine order limited to 9 tablets per 30 days to permit treatment of three acute gout flares. Thirty of the 90 patients had their colchicine order discontinued or allowed to expire.

Thirteen patients were approved to continue chronic colchicine therapy. Of those 13 patients, three continue colchicine therapy at a reduced dose. One patient had an alternative therapy added for gout management. As a result of this intervention using facility-approved restrictions for colchicine therapy, an estimated \$39,173.84 was avoided in medication expense for the facility. In addition, potential colchicine-related toxicity may have been avoided as a result of these medication changes. For future colchicine use, quantity and refill limits will be followed. Non-formulary review will be required for chronic colchicine therapy.

**Conclusion:** Facility-approved restrictions for colchicine therapy resulted in a variety of changes for patients prescribed colchicine therapy. Clinical pharmacists played a predominant role in review and assessment of colchicine therapy. A majority of the patients reviewed had therapy discontinued, were transitioned to an acute flare colchicine order or had expired orders that were not renewed. In addition to promoting safe and effective use of colchicine therapy, medication expense was reduced as a result of this clinical intervention.

**3-034**

**Category:** Ambulatory Care

**Title:** Constipation management in Lebanese community pharmacies

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**Purpose:** Constipation is a widely common condition and loads of laxatives are found as over the counter medications in the Lebanese community pharmacies. Patients knowledge on the use of such medications, causes and the clinical description of constipation, non-pharmacologic and pharmacologic management, and the possibility of self-medicating with multiple laxatives is the objective of this study.

**Methods:** A survey was developed and validated to assess the public knowledge of constipation, the clinical description of this condition, its causes, and the use of different laxatives in the community pharmacies in Lebanon. Eighteen categories of different laxatives (single agents or herbal combinations) have been identified and included in the survey. Pharmacy students were asked as part of their patient counseling to fill this form with patients coming into the pharmacies to have a laxative. The survey is composed of fifteen multiple choice questions and required an average of ten minutes to be filled.

**Results:** Survey data was analyzed based on 2457 responses (42.5 % male, 57.5 % female). The age of respondents varied between 1.5 and 95 years old. When asked about history of constipation, 43.5 % of the population has been suffering from constipation for more than a year and 35.6% reported acute constipation. Concerning the clinical description of constipation, 51.8 % experience straining, 55.7 % hard stools, 47.4% less than 3 bowel movements a week, and 40.4% are unable to defecate when desired. As for lifestyle habits, 59 % have tried hydration and fluids, 46.2 % have followed a fiber diet, and 30.2 % work out two to three times a week. It has been noted that 12.1 % of the patients have had a gastrointestinal past surgical history. Moreover, 23.1 % have reported taking Iron, 18.8 % are frequent Calcium containing antacids users, and 8.75% are scheduled on diuretics as concomitant medications, which are known to increase the likelihood of constipation. Finally, 21.9 % were on bisacodyl tablets, 19.3 % on lactulose syrup, 15.5 % use glycerin suppositories, and 14.5 % have been taking a combination of more than one laxative at the same time. It has been noted that most of the combinations included an herbal infusion of different constituents: senna, cascara, and licorice, with one of the fore mentioned options.

**Conclusion:** Based on the survey results, most participants needed counseling about the appropriate pharmacologic and non-pharmacologic management of constipation, and could benefit from such guidance in increasing their awareness related to different laxative products, safe daily use, and possible combinations. This project has served as a good opportunity for

pharmacy students to raise public attention on constipation management and pointed the community need for an awareness campaign on this subject.

**3-035**

**Category:** Ambulatory Care

**Title:** Assessment of Group-Based Diabetes Education Using the Medication Conversation Map in the Veteran Population

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**Purpose:** The Medication Conversation Map is a tool designed to facilitate small group discussion regarding diabetes management. Topics addressed include the progressive nature of diabetes, ABC (HbA1c, blood pressure, cholesterol) goals, short and long term complications of diabetes, lifestyle interventions, as well as medications for diabetes management. This study is designed to assess whether a pharmacist-led Medication Conversation Map session improves participant knowledge and attitudes regarding diabetes management in the veteran population.

**Methods:** This prospective pre-test/post-test study was conducted at a single site. The pre-test/post-test contained 20 questions designed to evaluate patient attitude using a Likert scale and knowledge using multiple choice questions with a single correct answer. Veterans included in the study completed an initial diabetes education course at least one year ago, had an HbA1c greater than or equal to 6.5 and were 25 to 80 years old. Veterans were excluded if they had diabetes mellitus type 1, gestational diabetes, were on dialysis, had HbA1c less than 6.5 or greater than 14, and/or lacked decision-making capacity, had a diagnosis of bipolar disorder, schizophrenia, mental retardation, organic mental disorder, were current users of illicit drugs, or were currently undergoing psychiatric treatment.

**Results:** Thirty two veterans were included in this study. Improvements were seen in both attitude and knowledge regarding diabetes management when comparing the pre-test with the post-test. Results of the attitude portion specifically showed statistically significant improvement in understanding the purpose of their diabetes medications, hypoglycemia management, and feeling prepared to make lifestyle changes for managing diabetes. The mean number of correct answers on the knowledge portion of the pre-test was 6 and the mean number of correct answers on the post-test was 8. This increase was statistically significant ( $p < 0.01$ ). Specific areas of improved knowledge included understanding HbA1c and blood pressure goals for diabetic patients as well as understanding which oral medication is most likely to cause hypoglycemia.

**Conclusion:** Based on these results, veterans appeared to be more knowledgeable regarding diabetes management, more confident in their ability to manage their condition, and were prepared to make changes in their daily life following the Conversation Map session. These promising results support continued use of the Medication Conversation Map Tool for small group diabetes education in the veteran population.

**3-036**

**Category:** Ambulatory Care

**Title:** Implementation of dabigatran use in a rural va setting

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**Purpose:** FDA approval of dabigatran has created a new paradigm for the treatment of patients with atrial fibrillation. Affords flexibility for patients and healthcare providers in monitoring, but also has concerns about long-term safety due being a new medication, not having an antidote, short half-life and lack of consistent monitoring. The purpose of this study is to discuss the implementation of dabigatran use in a rural va setting to ensure proper education, outcomes and disease management.

**Methods:** Patient database search was run for all patients with a dabigatran prescription at VA Black Hills HealthCare System (VA BHHCS) from December 2010 to May 2012. Specific patient data was then collected utilizing the electronic medical record. Information collected includes the following: 1) demographic information- patient identifier, dosage prescribed, date started; 2) Education-initial education, follow-up education (two weeks, one month, three months) 3) appropriateness for dabigatran therapy-CHADS2, diagnosis, creatinine clearance, inclusions and exclusions, formulary approval; 4) safety and outcomes- adverse drug reaction (ADR), hospitalizations, emergency room (ER) visits related to dabigatran, discontinuation of medication and reasoning, laboratory monitoring was recorded at baseline and three month follow-up.

**Results:** Patient database search identified forty-six patients who had a dabigatran prescription from December 2010-May 2012. Of these, forty four patients were included entirety of this study (two patients were not included due to receipt of dabigatran while inpatient). Three patients were not included in the education results due to being stable on dabigatran prior to obtaining from the VA. Education results: 80% of patients were monitored at baseline, 76% at two week follow-up, 73% at one month, 77% at three months. Appropriateness: 100% had formulary approval, diagnosis, inclusion and exclusion criteria, 98% met CHADS2 score >1, 95% met creatinine clearance >30ml/min. Safety and outcomes: 43% of patients experienced ADRs to dabigatran (mainly minor bleeding and GI upset); 14% discontinued medications as a result of ADR; there was one hospitalization related to dabigatran where patient experienced a CVA after stopping dabigatran for one week after experiencing a post operative bleed. Two ER visits one due to nose bleed and one gum bleeding post operatively. 90% of patients had baseline laboratory values, 74% had three month follow-up.

**Conclusion:** Although dabigatran provides the benefit of stroke prevention in atrial fibrillation patients and little to no monitoring, it is not devoid of concerns. As noted in our study despite

initial education, follow-up and adequate laboratory monitoring there were patients who had ADRs, discontinued medication, ER visits, and hospitalization related to dabigatran. While none of these were severe, it highlights the importance of carefully selecting patients for dabigatran therapy.

3-037

**Category:** Ambulatory Care

**Title:** Activities and impact of a clinical pharmacist in a patient-centered medical home (PCMH) practice within an integrated healthcare system: a three-month review

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**Purpose:** Sutter Health launched a pilot patient-centered medical home (PCMH) at one of its family medicine practice sites. A clinical pharmacist was integrated into the PCMH to enhance the quality of care and patient experience as well as augment the care of providers and care team by promoting medication safety and the avoidance of resource use.

**Methods:** The clinical pharmacist was integrated into the PCMH on November 1, 2011. Providers and the nurse care manager directly refer patients to the clinical pharmacist. Interventions of the clinical pharmacist are aimed at supporting the Coordination of Care (COC), which includes medication reconciliation, assisting with patient adherence, providing medication lists, and providing drug information; supporting Disease Management (DM) which encompasses disease state education, lab monitoring, and referrals to other healthcare providers; and lastly, performing Medication Therapy Management (MTM), such as ordering medication refills and adjusting medication therapy (for example, adding alternative or new medications, discontinuing medications, or modifying medications). All interventions performed by the clinical pharmacist are captured in an Access database.

**Results:** A total of 197 patients were referred to the clinical pharmacist during a three-month period (March 1, 2012 and May 31, 2012), comprising a total of 305 encounters that corresponded to 1,001 unique interventions. Fifty-two percent of patients were 65 years of age or older, 35 percent were 40-64 years of age, and 13 percent were 39 years of age or younger. The majority of patients had commercial insurance or Medicare. At the time of visit, 42 percent of the patients were taking 9 plus medications. Clinical pharmacist encounters were most often by phone (44 percent) and in-office consultation (39 percent), followed by online consults (9 percent), and clinician-only consults for drug information (8 percent). Encounters ranged in duration from less than 15 minutes (51 percent) to greater than 60 minutes (18 percent). Of the 1,001 interventions, supporting COC were the most frequent (52 percent) followed by DM and MTM (28 and 20 percent, respectively). The most common interventions supporting COC were providing drug information (42 percent) and performing medication reconciliation (21 percent). Disease state education was the most common intervention in DM (68 percent), comprising hypertension education and blood pressure measurements (42 percent), diabetes education and

glucometer measurements (18 percent), cardiovascular risk reduction education (15 percent) and cholesterol education (10 percent). The addition of a new medication (23 percent) and modification of a medication (23 percent) were the most common interventions for MTM. Modification of medications occurred due to cost (34 percent), dosing (28 percent), identification of potential adverse drug reactions (ADR) (19 percent), or sub-therapeutic dosing (19 percent). Discontinuation of medications occurred most frequently due to potential or demonstrated ADRs (59 percent). Of the 1,001 interventions captured, 35 percent were identified as improving the quality of care, 27 percent avoided resource use (emergency room visits, readmissions, or skilled nursing facility visits), 27 percent avoided a primary care physician (PCP) visit, and 11 percent promoted medication safety.

**Conclusion:** A clinical pharmacist plays an important role in a PCMH, assisting the providers and care team in improving medication safety, quality of care, and the avoidance of additional resource use. The initial success of this program has led to a change in the pharmacists status from part time to full time, and an expansion of the clinical pharmacists role to two other PCMH sites in our integrated healthcare system.

**3-038**

**Category:** Ambulatory Care

**Title:** Implementation of contract pharmacy services in a hospital outpatient hemophilia and thrombosis center utilizing the 340B drug pricing program

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**Purpose:** Contract pharmacy services were implemented to serve hemophilia patients of a Hemostasis and Thrombosis Center (HTC) in a 719 bed Academic Medical Center (AMC). Operations related to drug procurement, inventory management, and compliance with state and federal medication dispensing regulations have become increasingly complex as a result of several factors including management of both 340B and non-340B prices and inventories and auditing requirements. The Antihemophilic Factor (AHF) products are unique and require special ordering (i.e. direct purchase from individual manufacturers), continuous stable and appropriate storage conditions in accordance with package labeling, and confirmed medication delivery to patient. Contract pharmacy services were implemented to streamline the process and procedures of AHF procurement, inventory management, and dispensing procedures in addition to optimizing drug savings through utilization of the 340B drug pricing program.

**Methods:** The initial step in the implementation process was to contract with an independent vendor to facilitate and manage the formal request for proposal (RFP) to provide pharmacy services to patients of the HTC. The vendor assisted in the identification, evaluation, and selection of qualified 340B contract pharmacy service providers with home delivery capabilities. Three potential pharmacies with direct experience in providing AHF products and accompanying supplies were identified. Proposals and supporting documentation were solicited from identified pharmacies. Proposals were assessed by the vendor contracted to manage the RFP in collaboration with hospital and pharmacy leadership based on the following criteria; overall 340B knowledge and expertise, hemophilia 340B experience, data and reporting capabilities, financial impact, infrastructure including support services and depth of resources. A point system (1-5 point scale, where 1 = "non-competitive/limited" and 5 = "highly competitive/extensive") was utilized to rank the vendors in each category with results tracked on a ranking matrix grid. A mutually agreed upon contract and business associate agreement (BAA) were executed between the selected pharmacy and HTC. Registration of the pharmacy with the Health Resources and Services Administration (HRSA) Office of Pharmacy Affairs (OPA) was completed after contract execution. Active outreach to existing patients included an informational flyer and letter from the HTC. Additionally, an open forum was organized to provide patients with the opportunity to have questions and concerns answered. The contract pharmacy executed

contractual agreements with each manufacturer of the AHF products and established a Bill To/Ship To arrangement, where the hospital is invoiced for AHF products ordered and shipped to the vendor for subsequent dispensing to patients of the HTC. However, it was necessary for the HTC to develop temporary procurement and dispensing procedures for one of the AHF products as the manufacturers process to create a Bill To/Ship To arrangement takes 3-4 months. Policy and procedures were developed to provide patients with factor in emergent situations. Designated contract pharmacy personnel coordinate delivery and provide the HTC with patient adherence reports. On an ongoing basis an independent vendor completes routine audits to assist in maintaining appropriate compliance to both 340B program requirements and state and federal dispensing regulations.

**Results:** Contract pharmacy services for the HTC began on November 28, 2011. The pharmacy provides prescription mail delivery services for the patients of the HTC and serves as the 340B program administrator. Total utilization of this program has been 35 patients through May 31, 2012 representing 93 prescriptions and 2,765,090 units of factor dispensed. Routine account reviews between the contract pharmacy and HTC occur at least every 90 days to ensure program growth and compliance.

**Conclusion:** Successful implementation of contract pharmacy services for patients of the HTC has increased utilization of the 340B pricing program and ensured compliance to both state and federal medication dispensing regulations.

**3-039**

**Category:** Ambulatory Care

**Title:** Evaluating time in therapeutic range of warfarin patients self testing with point of care (POC) devices

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**Purpose:** To compare the time in therapeutic range of patients prior to and after receiving home INR POC monitoring devices.

**Methods:** This is a retrospective chart review of 60 patients who are using INR POC devices. Patients that began testing with POC devices between January 2005 and July 2011 were reviewed. The INR was categorized as therapeutic or non-therapeutic for at least 3 months prior to POC testing and at least 3 months after starting home testing. The primary endpoint was to determine INR time in therapeutic range. Patients were excluded for not having complete data for the time period in question or if they expired during the time period.

**Results:** Only 26 patients of the 60 patients using POC devices had adequate data collected to analyze. Of these 26 patients 16 were male and 10 were female. The total time in therapeutic range was 56.6% for a total of 7968 days. The time in therapeutic range calculated prior to patients receiving a POC device was 51.9%. After receiving the POC device the time in therapeutic range improved to 62.5%.

**Conclusion:** Patients home use of POC monitoring devices improved their time in therapeutic range. A majority of the POC patients reviewed were tested weekly as recommended which may help explain the increase of time in therapeutic range. It is also possible that these patients are more compliant due to the ease of monitoring on a home device rather than having a venous sample drawn. It is our conclusion that POC devices are effective in the management of warfarin patients who are unable or unwilling to have INRs drawn at the laboratory. Possible draw backs to the use of these devices are the increased staffing needed for frequent (weekly) monitoring and possible variability when compared to venous sampling.

**3-040**

**Category:** Ambulatory Care

**Title:** Evaluation of differences in percent of INRs in range between pharmacist-led and physician-led anticoagulation management service (AMS)

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**Purpose:** The safety and efficacy of warfarin depends upon maintaining the international normalized ratio (INR) in an established range. Numerous studies suggest that coordinated care with a systematic approach to anticoagulation results in an increase in the number of patients with greater time in the therapeutic range and a decrease in adverse events. The results from the study will conclude whether a coordinated approach led by a pharmacist improved percent of INRs in therapeutic range.

**Methods:** A retrospective chart review was conducted for patients at a Coastal Medical, Inc. office. INR data for patients receiving warfarin followed by a physician was collected from December 1st, 2009 to May 31st, 2010. These INR results were compared to INR results from December 1st, 2010 to May 31st, 2011, during which a pharmacist monitored INRs and adjusted warfarin doses. The primary endpoints were percent of INR results within goal range 2.0-3.0 and expanded goal range of 1.8-3.2 for the physician-led group versus the pharmacist-led group. Secondary endpoints included percent of INR results <1.5, <1.8, >3.5 and  $\geq 5.0$ . In addition, a subgroup analysis assessed differences in percent of INR results in range for non-initiators and crossover patients. We also compared these results by patient demographic and comorbid characteristics.

**Results:** No statistically significant differences existed in baseline characteristics between physician-led and pharmacist-led groups. Of the 237 patients prescribed warfarin during the study period, 96 were included in the physician-led group and 130 in the pharmacist-led group. All patients had a goal INR range of 2.0-3.0. The percent of all INR test results within the goal range (2.0-3.0) was greater among patients in the pharmacist-led as compared with patients in the physician-led group (57.5% versus 50.0%, respectively;  $p=0.0004$ ). The percent of INR results <1.5 (7.3% versus 5.1%) and >3.5 (11.4% versus 7.1%) were also statistically significant in favor of the pharmacist-led AMS, with p-values of 0.03 and 0.0004, respectively. The percent of INR results within the 2.0-3.0 goal range were also statistically significant in favor of the pharmacist-led patients in both the subgroup analysis of non-initiators and crossover patients.

**Conclusion:** A pharmacist-led AMS demonstrated improved anticoagulation control, with significantly less out of range INR results. The results from this retrospective analysis provided

information regarding the efficacy of the model at Coastal Medical, Inc. as consistent with findings of other studies of similarly structured pharmacist-managed AMS.

**3-041**

**Category:** Ambulatory Care

**Title:** Impact of pharmacist education and/or medication reconciliation on proton pump inhibitor use post discharge

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**Purpose:** Proton pump inhibitors (PPIs) provide a safe, well tolerated therapy for appropriate acid-related disorders. Studies show approximately 40-50% of patients on the adult medicine floor are started on PPIs and only 30-40% of those patients have an appropriate indication. Consequently, many are continued inappropriately upon discharge. Recently, the FDA identified several risks with the use of PPI therapy including risk of hip, wrist and spine fractures, hypomagnesemia, and clostridium difficile-associated diarrhea. Previous studies have shown pharmacists to be successful in reducing inappropriate PPI therapy. The purpose of the study was to determine the impact of pharmacist intervention on inappropriate PPI use through provider education plus medication reconciliation and provider education alone in the primary care setting.

**Methods:** This pilot study was approved by the Veterans Affairs Medical Center (VAMC) Institutional Review Board. A pharmacist presented an in-service regarding the appropriate indications and potential risks of PPI therapy to providers on all eight primary care teams at the VAMC just prior to the data collection period. For the next two month period, the medical records of all patients discharged from the hospital on omeprazole (preferred formulary PPI) were evaluated for appropriate PPI use. Post-discharge, a pharmacist performed medication reconciliation for patients on two of the eight provider teams who were discharged on a PPI. Recommendations were made to the providers prior to the patients first post-discharge primary care appointment. After these interventions, the records of all patients included were retrospectively reviewed by a pharmacist for appropriateness of PPI use after post-discharge follow-up. The primary objective of the study was to compare the percent of patients continued on inappropriate PPI therapy in the provider education only group versus the provider education plus medication reconciliation group after the post-discharge appointment. The secondary objective was to determine the number of patients started on omeprazole prior to or during the current admission and subsequently discharged on inappropriate PPI therapy.

**Results:** In the provider education only group (n=39), 24 patients were considered to be on inappropriate PPI therapy at discharge (61.5%) and 20 out of the 39 patients (51.3%) remained on inappropriate PPI therapy after the post-discharge primary care appointment; this 10.2%

decrease in inappropriate use did not achieve statistical significance. In the education plus medication reconciliation group (n=23), 9 patients were on inappropriate PPI therapy at discharge (39.1%) and 3 out of the 23 patients (13%) remained on inappropriate PPI therapy after the post-discharge primary care appointment, a 26.1% reduction ( $p < 0.05$ ). The difference in discontinuation rates between groups failed to reach statistical significance ( $p < 0.08$ ). For the secondary objectives, 53 patients were on PPI therapy prior to admission and 30 were discharged on inappropriate PPI therapy. Nine patients were initiated on PPI therapy during the hospital admission and three were discharged on inappropriate PPI therapy.

**Conclusion:** In this pilot study, more than half of the patients at VAMC were on an inappropriate PPI at discharge. After the post discharge follow-up appointment in primary care, there was a non-significant ( $p < 0.08$ ) trend showing a greater decrease in inappropriate PPI use in the pharmacist conducted medication reconciliation plus provider education group than in the provider education group alone. The combined provider education and medication reconciliation by a pharmacist intervention did significantly decrease inappropriate PPI use following discharge from the hospital.

**3-042**

**Category:** Ambulatory Care

**Title:** Outcome of a standardized conversion protocol in veteran patients receiving simvastatin and gemfibrozil

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**Purpose:** The FDA recently released a safety alert detailing higher rates of myopathy and rhabdomyolysis associated with the combination of simvastatin and gemfibrozil; the use of these medications together is now contraindicated. The purpose of this study was to evaluate the outcome of an automatic conversion protocol in patients prescribed both simvastatin and gemfibrozil with a baseline triglyceride (TG) measurement of 150 mg/dL or less.

**Methods:** A retrospective medication use evaluation was conducted on a population of Veterans Affairs outpatient clinic patients. The initial population included 151 patients who received prescriptions for both gemfibrozil and simvastatin and had a triglyceride of 150 mg/dL obtained in the previous year. In the 89 patients included in the primary analysis, 8 patients met triglyceride goal but not LDL goal at baseline and 81 patients met both triglyceride and LDL goals at baseline. The main outcome measures included average change in lipid parameters (TC, TG, LDL, HDL). Secondary outcomes included adverse events and change in liver function tests.

**Results:** In 81 patients who met both TG and LDL goals at baseline, there was a statistically significant increase in the average triglycerides pre- and post-intervention (107.5 vs. 159.5 mg/dL;  $p < 0.001$ ). Additionally, there was a statistically significant change in average LDL (81.2 vs. 75.0 mg/dL;  $p = 0.01$ ) and average ALT pre- and post-intervention (19.6 vs. 27 mg/dL;  $p < 0.001$ ). Average TC, HDL and AST were not significantly different. In patients who did not meet LDL goal at baseline, there was a statistically significant increase in average triglycerides pre- and post-intervention (107.6 vs. 156.1 mg/dL;  $p = 0.01$ ); average LDL did not change significantly (119.6 vs. 119.1 mg/dL;  $p = 0.82$ ) nor total cholesterol, HDL or AST/ALT. No adverse events were reported following intervention attributable to the cholesterol medications.

**Conclusion:** Application of an automatic conversion protocol resulted in a statistically, but not clinically, significant change in triglyceride concentrations. Other lipid parameters were not significantly impacted by the intervention.

**3-043**

**Category:** Ambulatory Care

**Title:** Expanded outpatient pharmacist role in preventive care and chronic condition monitoring

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**Purpose:** Preventive care and chronic condition monitoring is crucial to improving healthcare outcomes. Frequent in-person patient interactions present pharmacists with a great, often untapped opportunity to improve these outcomes. Our integrated health care system, electronic medical record and support tools allow the pharmacist to seize this opportunity to engage patients.

**Methods:** The outpatient pharmacy staff developed this innovative approach for reminding patients about needed screening and monitoring procedures when they came into the pharmacy to pick up their medications. The reminders came from the Patient Support Tool, an integrated information tool that provides readily accessible, up-to-date, individualized care recommendations for patients. Documentation of the consultation and recommendations was entered into the electronic medical record. After a pilot at one medical office pharmacy this approach was declared a best practice and spread to 20 medical offices and 600 pharmacy staff. Both pharmacists and technicians had roles in this process. Training for the pharmacists included patient engagement, increased familiarity with prevention and monitoring, as well as answers to common questions and concerns. Training for the technicians included how to access and print the Patient Support Tool report.

**Results:** We found that 18 to 20 percent of preventive and chronic condition monitoring procedures were completed as a result of the conversation with the pharmacist. During the second half of 2011, pharmacists discussed 56,959 procedures with 40,127 patients. This conversation added just over 1 minute to the time spent on a standard pharmacy consult. Pharmacists reported patients were receptive to the reminders and the pharmacists themselves reported increased satisfaction and improved perception of their value as a member of the health care team.

**Conclusion:** Incorporating preventive care and chronic condition monitoring discussions into pharmacy consults has had a positive impact on pharmacist and patient satisfaction, improved health care outcomes and made a significant contribution to our region achieving a 5-star Medicare rating.

**3-044**

**Category:** Ambulatory Care

**Title:** The Impact of Collaboration Between Clinical Pharmacists and Nurse Care Managers on Diabetic Patients with Hemoglobin A1c above 9%

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**Purpose:** The growing prevalence of diabetes mellitus warrants exploration of innovative approaches to effectively manage diabetic patients. The concept of the Patient-Centered Medical Home (PCMH), a term initially coined in the 1960s, has regained popularity in recent years. In 2010, Veterans Health Administration implemented Patient Aligned Care Teams (PACT) to execute the principles of the PCMH model. PACT operates as an interdisciplinary team, delivering coordinated care with each member serving specific roles that s/he is best trained to contribute. At the San Francisco Veterans Affairs Medical Center, Clinical Pharmacists are active members of PACT and work in collaboration with Nurse Care Managers. The purpose of this study is to evaluate the impact of PharmD-RN collaborative care on glycemic control in patients with hemoglobin A1c (HbA1c) 9% under the care of current traditional models.

**Methods:** The institutional review board approved this retrospective study of patients receiving PharmD-RN collaborative care. Patients were included if they were diagnosed with diabetes mellitus, had HbA1c 9% at baseline, and received PharmD-RN collaborative care. Patients were excluded if they initiated PharmD-RN collaborative care after December 31, 2011, refused care from the Clinical Pharmacist and/or Nurse Care Manager, transferred care, or were lost to follow-up. Medical records of patients who had received PharmD-RN collaborative care were reviewed. The percentage of patients with HbA1c < 9% at the end of the study period and the percentage of patients that achieved HbA1c goal were determined. Workload of this model and incidence of adverse effects associated with the diabetes medication regimens were also assessed.

**Results:** 51 patients met the eligibility criteria. At the end of the study period, 32 patients (62.75%) achieved HbA1c < 9%. Of those that achieved HbA1c < 9%, 9 patients (28.13%) met HbA1c goal. Patients had on average one clinic visit with the Clinical Pharmacist per 1.74 months and one high HbA1c call with the Nurse Care Manager per 3.39 months. Clinical Pharmacists recommended a total of 201 medication changes, all of which were accepted. 11.94% of these changes were medication initiations, 81.09% were medication titrations, and 6.97% were medication discontinuations. The most common adverse drug events were mild hypoglycemia (47.06%) and diarrhea (5.88%).

**Conclusion:** Collaboration between Clinical Pharmacists and Nurse Care Managers is associated with HbA1c improvements in patients with baseline HbA1c 9%.

**3-045**

**Category:** Ambulatory Care

**Title:** Implementation of pharmacy medication therapy management (MTM) services in the patient aligned care team (PACT) model and the impact on dyslipidemia

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**Purpose:** In 2010, the Veterans Health Administration directed VA medical centers to adopt a new patient-driven, team-based approach that delivers efficient, comprehensive, and continuous care through active communication and coordination of resources. The new directive promoted all team members to function at the top of their licensure and provide collaborative patient care. That same year VA Central Iowa Healthcare System did not meet the facility dyslipidemia quality measure which was defined as 70% of all patients with CHD or CHD risk equivalent meeting LDL goal of less than 100 mg/dL. This MTM dyslipidemia service was designed to assist primary care clinics in achieving their quality measure, strengthening the relationships between pharmacy and outpatient clinics, and to allow qualified pharmacists to practice at the top of their licensure with prescribing privileges.

**Methods:** A scope of practice was developed for pharmacists to serve as providers with prescribing privileges within dyslipidemia management. The specific prescribing privileges were outlined within the scope of practice and approved by the Chief of Medical Staff and Executive Committee of the Medical Staff. Competencies were then created by the Assistant Chief of Pharmacy to ensure each participating pharmacist delivered the highest quality of care and was in accordance with evidence base literature and best practice policies. Patients were identified for MTM service one of three ways: (1) a formal consult entered by the primary care provider, (2) as being on multiple dyslipidemia agents with critical drug-drug interactions, or (3) those who were not meeting the facility quality measures as identified through chart reviews. Three specialized pharmacists conducted a thorough chart review and enrolled veterans into the PACT pharmacy medication management clinic. The majority of the MTM dyslipidemia services were conducted as phone visits with a few face to face clinic visits.

**Results:** After nine months, 404 patients were consulted for MTM dyslipidemia services. 250 have lipid panels available for review and outcomes analysis. Upon initial enrollment to the PACT pharmacy dyslipidemia service 40% (n=102) of these patients were at LDL goal upon enrollment as defined by NCEP ATP III guidelines. After intervention by PACT pharmacists, 75% (n=188) of these patients met LDL treatment goals. 181 patients had a CHD or CHD equivalent diagnosis that qualified them for LDL goal of less than 100 mg/dL (optional less than

70 mg/dL). Prior to PACT pharmacy intervention, only 68 patients of the 181 (34%) were at LDL goal of less than 100 mg/dL. After chart review and intervention, 75% (n=149) met LDL goal and the facilities dyslipidemia quality measure. 154 patients have consults in various stages of review including 59 that have been evaluated but still awaiting follow-up lab work for assessment, 72 yet to be reviewed, and 23 are inactive due to various reasons (patient deceased, patient declined enrollment, terminal illness, referred to specialty for management, etc).

**Conclusion:** Incorporating clinical pharmacy MTM services as part of the patient aligned care team has had a positive impact on dyslipidemia with majority of patients achieving LDL treatment goals. Control of LDL is proven to contribute to a reduction in cardiovascular mortality; therefore, contributions of the clinical pharmacy services within primary care clinics have improved patient outcomes at VA Central Iowa Healthcare Systems.

**3-046**

**Category:** Ambulatory Care

**Title:** TeleQuit CRAVES: Counseling Referrals and Abstinence for Veterans Enrolled in Smoking cessation

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**Purpose:** TeleQuit, a telephone-based smoking cessation clinic run by pharmacists, is one of two available smoking cessation programs at the Veterans Affairs Long Beach Healthcare System (VALBHS). Veterans who expressed interest in smoking cessation received a brief telephone consultation and subsequently received nicotine replacement therapy and/or bupropion in the mail. A formal evaluation of the TeleQuit program was performed in 2006 to assess the effectiveness of TeleQuit. In 2011, efforts were made to modify the existing TeleQuit program. Extensive psychosocial and medication counseling were incorporated into the initial call for veterans who sought help with smoking cessation. The purpose of this study was to compare smoking cessation outcomes of TeleQuit before and after implementation of extensive psychosocial and medication counseling.

**Methods:** This is an IRB-approved retrospective study. The initial patient population was identified by the VISN 22 Data Manager who used the VA Corporate Data Warehouse to extract a list of TeleQuit consults placed by VALBHS providers from January 2011 to July 2011. Patients were included if they received both an initial and 6-month follow-up call. Patients were excluded if they were unwilling to receive counseling, unreachable at 6-month follow-up call, and patients who received face-to-face instead of telephone counseling. Primary outcome was 6-month continuous abstinence. Secondary outcomes were 7-day point prevalence for abstinence, duration of abstinence, reasons for relapse, and percentage of relapsers who reduced cigarette smoking. Statistical analyses included chi-square test, descriptive statistics, McNemars test, and t-test for the different comparative and outcome variables.

**Results:** 118 patients were included in the study. The 6-month continuous abstinence rate was 16.9% and 11% in 2011 and 2006, respectively ( $p=0.21$ ). The 7-day point prevalence was 28.8% in 2011 and 21% in 2006 ( $p=0.185$ ). In 2006, 55% of smokers did not attempt to quit smoking. This rate was reduced to 30.1% in 2011 ( $p<0.01$ ). A higher percentage of relapsers stayed off cigarettes for up to 3 months in 2011 compared to 2006 (18.1% vs 6.7%,  $p=0.02$ ). Data from 2011 also showed that 33.7% of relapsers cited general stress or specific life crisis as the prominent reason for relapse. 67.5% of relapsers reduced the number of cigarettes smoked per day and on average, relapsers smoked 22 cigarettes daily at initial consultation compared to 13.6 cigarettes daily at follow-up call ( $p<0.01$ ).

**Conclusion:** Our study suggested a trend towards improvement in smoking cessation outcomes with extensive psychosocial and medication counseling. Data showed the main reasons for relapse were general stress or specific life crisis. However, a higher number of relapsers attempted to quit smoking and stayed off cigarettes for a longer duration of time in 2011 than in 2006. Those who relapsed also reduced the number of cigarettes smoked per day at 6-month follow-up.

**3-047**

**Category:** Ambulatory Care

**Title:** Pharmacist analysis of a quality improvement registry to identify possible interventions in a patient centered medical home.

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**Purpose:** The patient-centered medical home (PCMH) model promises to transform the delivery and payment structure of primary care by improving the quality, safety, efficiency, and effectiveness of health care at the individual patient and population levels. The role of pharmacists in the medical home often includes delivering individual patient care. However, pharmacists may also be involved in population health activities such as developing medication safety policies and procedures, identifying needs for new or expanded chronic care management programs, collaborating with quality improvement staff on educational programs, or working with information technology staff to enhance documentation and reporting of patient medication related data. Such services can include query of patient registries to evaluate and implement practice-based medication and safety interventions. Faculty from a school of pharmacy were involved in direct patient care, and served on multidisciplinary quality improvement teams aimed at establishing PCMHs in 2 geographically and ethnically diverse family medicine clinics in central Massachusetts. The objective of this evaluation was to compare baseline patient demographics and the use of medication-related quality measures in our clinics using quality improvement registries. We also planned to identify areas for individual and population-based pharmacist intervention as part of the PCMH.

**Methods:** Methods: Retrospective review of family medicine practice registries generated from the electronic health record representing data through end of April 2012 for a rural and urban practice site was conducted. Prespecified variables were HbA1c, low density lipoprotein (LDL), systolic and diastolic blood pressure (BP) in smoking or non-smoking patients receiving angiotensin converting enzyme inhibitor (ACEI)/angiotensin II receptor blocker (ARB) therapy or a statin. Distributions were evaluated and t-tests were used for normally distributed linear variables. Wilcoxon-ranks was used for medians and categorical variables were evaluated using Pearsons chi-squared or Fishers Exact test as appropriate.

**Results:** Results: Registry analysis revealed adult patient populations of 6904 at the rural site and 6777 at the urban site. There were more women in the urban practice and the mean age was more than 4 years younger than the rural practice (p less than 0.0001 for both comparisons). There were more smokers and patients with diabetes in the urban practice with fewer patients receiving statins (p less than 0.0001 for all comparisons). The rural practice had more patients

with hypertension and coronary disease receiving statins, though fewer patients were receiving ACEI/ARB therapy (p less than 0.01 for all comparisons).

**Conclusion:** Conclusions: A younger urban health center population was found to have more diabetes and more smokers and also have proportionally more patients on ACEI/ARB therapy to address blood pressure, renal protection and to protect against early metabolic and microvascular disease. An older rural health center population was found to have more patients with hypertension and coronary artery disease, fewer patients on ACEI/ARB therapy and more patients on statins. This population may have less early metabolic disease but more advanced vascular disease.

**3-048**

**Category:** Ambulatory Care

**Title:** Comparison of efficacy and tolerability between niacin extended-release and sustained-release niacin after formulary conversion

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**Purpose:** Dyslipidemia is highly correlated with coronary heart disease, which is the leading cause of death in the United States. Niacin has been shown to decrease LDL cholesterol, triglycerides, and increase HDL cholesterol. While there are several prescription and non-prescription niacin products, they may differ in efficacy, toxicity, and metabolism. Due to a national formulary change, patients on niacin extended-release were converted to sustained-release niacin (Slo-Niacin) according to the VA Long Beach Conversion Protocol. However, there is insufficient data directly comparing the long term efficacy and tolerability between these two niacin formulations. The purpose of this study was to evaluate long term efficacy and safety outcomes following the conversion from niacin extended-release to sustained-release niacin.

**Methods:** This was a retrospective cohort study of pharmacy records and laboratory results using data extracted from the VA Regional Data Warehouse and chart review. Patients who were previously on niacin extended release and switched to sustained release niacin between 9/1/2010 and 9/1/2011 were included in the analysis. Patients were excluded from the study analysis if they had a gap in therapy of more than 180 days between the two formulations. Primary endpoints included changes in lipid panel (total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides), AST, ALT, and CPK before and after conversion at 3, 6, and 12 months in the general patient cohort and in subgroups of patients with previous history of hepatic dysfunction or myopathy. Discontinuation rate and reasons for discontinuation of sustained release niacin were evaluated using chart review. Descriptive statistics, paired t-test, and Wilcoxon signed-rank test were performed.

**Results:** 1422 patients met inclusion and exclusion criteria and were used for data analysis. The mean change in LDL cholesterol after formulary conversion to sustained release niacin was a decrease of 2.3 mg/dL (p less than 0.05) at 3 months, a decrease of 2.7 mg/dL (p equals 0.07) at 6 months, and a decrease of 4.6 mg/dL (p less than 0.05) at 12 months. Mean HDL cholesterol was increased by 1.51 mg/dL (p less than 0.05), 2.49 mg/dL (p less than 0.05), and 1.38mg/dL (p less than 0.05) at 3, 6, and 12 months respectively. There was no statistically significant change in triglycerides at all time points. Mean total cholesterol was decreased by 1.69 mg/dL (p equals 0.27), increased by 0.27 mg/dL (p equals 0.86), and decreased by 3.94 mg/dL (p less than 0.05) at 3, 6, and 12 months respectively. Mean AST was increased by 0.5 IU/L (p equals 0.37) at 3

months, 0.35 IU/L (p equals 0.39) at 6 months, and 1.66 IU/L (p less than 0.05) at 12 months. Mean ALT was increased by 1.7 IU/L (p less than 0.05) at 3 months, 0.77 IU/L at 6 months (p equals 0.07), and 1.27 IU/L (p less than 0.05) at 12 months. Overall, changes in lipid panel, AST, and ALT were small and were not considered clinically significant. Discontinuation rate of sustained release niacin was 9 percent in all patients. The most common reason for discontinuation was due to well controlled lipid panel (2.5 percent). Second most common reason was due to itching, flushing, and rash (1.8 percent). There was no statistically significant difference in AST, ALT and CPK in patients with history of hepatic dysfunction and myopathy respectively.

**Conclusion:** Sustained release niacin was well tolerated and equally efficacious compared to niacin extended release in a veteran population after a formulary conversion. While some laboratory values were statistically significant, they are not considered clinically significant. Sustained release niacin was also well tolerated in patients with previous history of hepatic dysfunction and myopathy.

**3-049**

**Category:** Ambulatory Care

**Title:** Evaluation of the maintenance of glycemic control in veterans discharged from a pharmacist-managed diabetes clinic

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**Purpose:** Diabetes care is multifaceted and requires multiple interventions to achieve optimal glycemic control and to manage or prevent long-term complications. Since diabetes care requires complex medication therapy management, frequent monitoring, and lifestyle modifications, pharmacists play an integral role in its management. Previous trials looking at the effect of clinical pharmacist interventions on the management of diabetes have demonstrated significant impact on achieving hemoglobin A1c (A1c) goals. At the Jesse Brown VA Medical Center (JBVAMC), patients with A1c greater than or equal to 9 percent may be enrolled in the pharmacist-managed diabetes clinic. As patients achieve A1c less than 9 percent, they are discharged from the clinic and transferred to primary care for further diabetes management. Maintenance of these outcomes after patients are discharged from pharmacist-managed clinics has yet to be evaluated. The purpose of this study was to evaluate whether veterans discharged from the pharmacist-managed diabetes clinic were able to maintain glycemic control below the A1c value of 9 percent.

**Methods:** This study was a retrospective, electronic chart review of patients with an ICD9 diagnosis of type 2 diabetes mellitus (DM2) who were evaluated in the diabetes clinic from January 2009 through the end of data collection. Data was collected from January 1, 2008 through September 15, 2011 to allow for assessment of baseline and follow-up laboratory parameters. Patients at least 18 years old with a diagnosis of DM2, a baseline A1c of greater than or equal to 9 percent, at least two documented diabetes clinic visits and a documented transfer of care from the diabetes clinic to primary care were included in the study. Exclusion criteria included patients who were lost to follow-up after one diabetes clinic visit, patients who did not have a followup A1c after the initial diabetes clinic visit or within 12 months after discharge from the diabetes clinic, and/or prior to September 15, 2011. The primary endpoint was the number of patients who were able to maintain their A1c less than 9 percent within 12 months after discharge from the diabetes clinic. Secondary endpoints included change in A1c and weight (kg) within 12 months after discharge from the diabetes clinic, follow-up visit with the primary care team, re-enrollment to the diabetes clinic after the initial discharge, and medication and appointment adherence.

**Results:** Overall, 64 percent of the study population maintained their A1c below 9 percent within 12 months after discharge from a pharmacist-managed diabetes clinic. All patients included in this study had an appropriate transfer of care from the diabetes clinic to the primary care team. There were approximately 1.4 diabetes clinic visits per patient per month, and this was unchanged between those who maintained their A1c and those who did not. In addition, patients who maintained their A1c below 9 percent had slightly better medication and appointment compliance, but this was not significantly different from patients who had an elevated A1c greater than or equal to 9 percent after 12 months.

**Conclusion:** The majority of the study population maintained their A1c below 9 percent within 12 months after discharge from the pharmacist-managed diabetes clinic.

**3-050**

**Category:** Ambulatory Care

**Title:** Evaluation of outcomes of two anticoagulation management services

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**Purpose:** The Outpatient Clinic Anticoagulation Service (OCAS) is a pharmacist managed anticoagulation clinic, that was initially a telephone based anticoagulation service, and was then transitioned to a point of care testing (POCT) with scheduled patients visits at the outpatient clinics. This transition occurred in January 2011. We tested the hypothesis that POCT is more efficient service in maintaining INR stability and reducing adverse events.

**Methods:** The institutional review board approved the retrospective chart-review. All patients enrolled in OCAS from July 2010 to June 2011 were included. Demographic data and information on anticoagulation stability were retrieved for the purpose of the study. The primary objective was the total time in therapeutic range (TTR). Secondary objectives included proportion of visits with INR at target range less than 2.0 or greater than 3.0 or 4.0 and INR standard deviation. To assess if POCT required less anticoagulation management, we measured the proportion of visits with weekly dose changes, time between scheduled visits and emergent clinic visits. We also recorded the proportion of visits with adverse events.

**Results:** A total of 38 patients were identified. The POCT demonstrated a higher TTR (61.7 versus 68.8 percent; P less than 0.02) and fewer emergent clinic visits (6.8 versus 3 percent; P less than 0.03) compared to telephone managed service. There were no differences between the two services in all other measured outcomes including the frequency of adverse events.

**Conclusion:** POCT is a more efficient service than telephone managed anticoagulation clinic in achieving INR stability. Clinical studies involving a larger population are needed to confirm this hypothesis.

**3-051**

**Category:** Ambulatory Care

**Title:** Patient satisfaction with liver clinic health care providers during hepatitis C virus management

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**Purpose:** Clinical pharmacist intervention in the management of chronic disease states has been associated with improved patient outcomes, adherence, and overall quality of care delivered by the health care team. The goal of this project is to determine the degree of satisfaction hepatitis C virus (HCV) patients have with clinical pharmacist services compared to physician services provided at an urban university liver clinic, and to identify areas needing improvement to optimize patient care.

**Methods:** A patient satisfaction survey was offered to patients who were beginning or currently undergoing HCV treatment under the care of a clinical pharmacist. Participation was voluntary and survey responses were anonymous. Survey items included basic demographic information, and assessed patients' satisfaction with accessibility of care, wait time, quality of recommendations, education about HCV medications, and medication side effect management. At the HCV treatment initiation visit, patients were asked to evaluate care from physicians with 17 Likert-scale questions (1 = poor, 2 = fair, 3 = okay, 4 = good, 5 = great) and 2 open-ended questions. Approximately 3 months after the initiation of HCV treatment, patients were asked to evaluate care from the clinical pharmacist with 20 Likert-scale questions with 3 open-ended questions. Survey results were analyzed via comparative and descriptive statistics. A qualitative content analysis was used for the open-ended survey questions. The study design was cross-sectional and non-experimental.

**Results:** Eighty-one patients completed the satisfaction survey (53 physician surveys and 28 pharmacist surveys). The mean patient age was 53 years. The median score was 5 for all questions regarding care from the clinical pharmacist. Two items on the physician surveys had a median of 4: spending time with the patient, and wait time. Overall satisfaction with both the physicians and pharmacists was high (median = 5). Areas needing improvement, indicated by open-ended responses, include patients seeing the same physician at each appointment, and improvement in helpfulness of the front desk staff.

**Conclusion:** The high level of patient satisfaction with the clinical pharmacist may serve as support for other institutions considering the incorporation of clinical pharmacists into their

medical teams. Satisfaction survey results can be used to improve patient care, and this survey may serve as a model for assessment of satisfaction in other pharmacist-run clinic settings.

**3-052**

**Category:** Ambulatory Care

**Title:** Retrospective review of vitamin D levels, supplementation, and early virological response in hepatitis C genotype 1 patients on dual and triple medication therapy

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**Purpose:** Normal vitamin D levels in hepatitis C virus (HCV) genotype 1 patients have been associated with an increased virological response to dual therapy with pegylated interferon and ribavirin; no published data exists on the correlation of vitamin D with virological response to triple HCV therapy with a protease inhibitor. This study retrospectively evaluates the relationship between baseline vitamin D levels, supplementation, and early virological response in genotype 1 HCV patients on both dual and triple HCV therapy.

**Methods:** Investigators reviewed the electronic medical records of all HCV patients treated by the clinical pharmacist at an urban university liver clinic from June 1, 2009 through April 18, 2012. Data collection included HCV levels and vitamin D levels at baseline and week 12 of treatment, and the status of vitamin D supplementation. Non-genotype 1 HCV patients, patients without baseline vitamin D levels, and patients who completed less than 12 weeks of HCV treatment were excluded.

**Results:** Of the 193 patient charts reviewed, 72 qualified for our analysis (25 patients on dual therapy and 47 patients on triple therapy). Fourteen (56%) of the dual therapy patients had low vitamin D levels at baseline, while 17 (36%) of the triple therapy patients were deficient at baseline. Twenty (80%) of the dual therapy patients and 24 (51%) of the triple therapy patients received vitamin D supplementation during HCV treatment. At week 12 of the dual therapy, 4 (16%) of the patients supplemented with vitamin D and 2 (8%) of the patients without supplementation had undetectable viral loads ( $p=0.25$ ). At week 12 of the triple therapy group, 19 (45%) of the patients supplemented with vitamin D and 13 (31%) of those without supplementation had undetectable viral loads ( $p=0.47$ ). Two (15%) of the dual therapy patients with a low baseline vitamin D level had undetectable viral loads at week 12, compared to 14 (82%) of triple therapy patients ( $p<0.001$ ). Four (17%) of the dual therapy patients with a normal baseline vitamin D level had undetectable viral loads at week 12, compared to 18 (43%) of triple therapy patients ( $p=0.07$ ).

**Conclusion:** Vitamin D supplementation was not associated with a difference in rate of viral clearance at week 12 in patients on dual or triple therapy. More patients with low baseline vitamin D levels in the triple therapy group cleared the virus at week 12 compared to the dual therapy group, which may indicate that inadequate baseline vitamin D levels are not associated with a decrease in viral clearance at week 12 with triple therapy. Long-term studies with larger sample sizes are needed to establish a correlation between vitamin D levels, vitamin D supplementation, and continued virological response to triple HCV therapy.

**3-053**

**Category:** Ambulatory Care

**Title:** Use of over-the-counter medications and dietary supplements among elderly in the Lebanese population

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**Purpose:** In the Lebanese population, little if any information is available on the use of over-the-counter medications (OTC) and dietary supplements. The objective of this study is to evaluate the prevalence and patterns of medication use among elderly Lebanese patients.

**Methods:** This study was conducted in Lebanese community pharmacies for a period of 6 months from February 2011 till August 2011. One thousand seven hundred and eleven elderly patients were interviewed to assess the use of OTC and dietary supplements. The patient population included elderly aged 57 through >85 years from different regions of Lebanon including Beirut, the North of Lebanon, the South of Lebanon, the Bekaa Valley and Mount Lebanon. The following information was collected from interviewed elderly: age, gender, highest education attained, household income, living location, availability of third party payer, self-reported health, self-reported medical problems, OTC use, Dietary supplement use, self-reported compliance, use of single or polypharmacy, and whether counseling was provided to patients during medication purchase.

**Results:** Fifty eight percent of the interviewed elderly did not complete their high-school education and fifty six considered themselves of average household income. Forty one percent did not have any third party payers, paid for these medications out of pocket and reported their health status to be good. The highest self-reported medical problem was hypertension followed by diabetes, dyslipidemia and gastrointestinal problems. The most commonly used OTC medications were paracetamol or acetaminophen (50%) and aspirin (42%). Among dietary supplement users, 25% used multivitamins and 24% used calcium. The majority reported very good overall compliance with OTC and supplements when used and commitment to one single pharmacy. Counseling was provided by physicians in 62% of the cases as compared to pharmacists (38%).

**Conclusion:** In this sample of community elderly patients, nonprescription medications were commonly used with a variety of over the counter medications and supplements offering great opportunity for pharmacists interventions and counseling particularly that the majority of the patients tend of utilize a single pharmacy for their source.

**3-054**

**Category:** Automation / Informatics

**Title:** Implementing a downtime contingency plan for carousel dispensing technology (CDT) in a community hospital inpatient pharmacy

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**Purpose:** Carousel dispensing technology (CDT) is a popular method of storing and dispensing medications in hospital pharmacies. The overall reliability of CDT allows for safe and efficient dispensing of medications. However, because the CDT relies primarily on motorized machinery, there is always a risk of mechanical failure. This institution implemented CDT in 2009 and had essentially no downtime until 2012, when a mechanical failure rendered the CDT unusable for several hours. This project was designed to devise a comprehensive contingency plan for medication distribution in the event of unexpected or prolonged downtime of the CDT.

**Methods:** Pharmacy leadership convened to assess both the appropriateness of the medications stocked in the CDT and the potential clinical impact of a downtime that prevents access to those medications. Medications were reviewed based on clinical urgency and availability from other locations. Items were placed in three categories: items with high clinical urgency that should not be stocked in the CDT, items with moderate-to-high clinical urgency but are stocked in other locations within the facility (e.g. automated dispensing cabinets, satellite pharmacy, etc.), and items with lower clinical urgency that could be safely obtained from the pharmacy wholesaler within two to three hours. The categories were used to determine the most appropriate storage location for the medications.

**Results:** The review of the CDT contents resulted in three key actions. Four medications were removed from the CDT permanently, as they were deemed too time-critical to risk a delay due to mechanical failure. Second, the pharmacy team developed an emergency wholesaler order that could be placed rapidly for immediate delivery. Third, the pharmacy leadership team revised the existing downtime plan to clearly direct pharmacy staff to alternate locations for medications stored throughout the facility. Finally, written guidance was added to the downtime plan to offer strategies for medication removal and storage should the CDT need to be emptied until a repair occurs.

**Conclusion:** While mechanical failure is rare with CDT, the risk of such a failure makes the storage of some medications within this technology less than ideal. For those medications that are stocked in CDT, a contingency plan for emergency procurement of medications allows a seamless continuation of pharmacy operations when CDT access to medications is limited or unavailable, and ensures that the pharmacy meets the medication needs of the patients.

**3-055**

**Category:** Automation / Informatics

**Title:** Evaluating the implementation of drug monograph decision support software for warfarin critical drug interactions

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**Purpose:** Previous studies have demonstrated that most prescribers and pharmacists do not provide clinically useful responses to real time drug drug interaction (DDI) alerts. The implementation of drug monograph decision support software at the point of care may provide health care providers with useful information in the management of critical DDIs. The objective of this study was to assess the impact of drug monograph decision support software on prescriber and pharmacist useful response rates to warfarin critical DDI alerts.

**Methods:** This study was approved by the institutional review board. This retrospective study included all outpatients and inpatients at our facility with a new warfarin critical DDI between June 1, 2011 and January 31, 2012. Prescriber and pharmacist responses to warfarin critical DDIs were categorized as being clinically useful or not by two independent evaluators. Discrepancies were resolved after consulting a third evaluator. The number of concurrent order checks with DDIs was evaluated for impact on useful responses. Results from this study were compared to historical data previously published for the study institution.

**Results:** Over the 8 month study period, 174 new warfarin critical DDIs were included. Amiodarone, sulfamethoxazole trimethoprim and metronidazole were the most common DDIs with warfarin. The majority of DDI alerts were generated in the inpatient setting (63.8 percent) versus the outpatient setting (36.2 percent). 42.5 percent of prescriber responses were clinically useful, compared with 71.7 percent of pharmacist responses. 69 percent of the DDI alerts had between 0 and 2 concurrent order checks with an average clinical usefulness of 51.7 percent. The remaining 31 percent of DDI alerts had 3 or more concurrent order checks with an average clinical usefulness of 22.2 percent. Compared to historical data for the institution, the total clinical usefulness of prescriber and pharmacist responses increased from 19.7 to 42.5 percent (p less than 0.001) and from 9.5 to 71.7 percent (p less than 0.001), respectively.

**Conclusion:** Drug monograph decision support may contribute to improved clinical usefulness of prescriber and pharmacist responses to warfarin critical DDIs.

**3-056**

**Category:** Automation / Informatics

**Title:** Pharmacists use of iPads to facilitate decentralized pharmacy services

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**Purpose:** Decentralized pharmacists at Boston Children's Hospital participate in daily rounds and work directly with multidisciplinary care teams in determining and monitoring medication regimens. In order to be effective, pharmacists require immediate facile access to drug information resources as well as patients' electronic health record (Cerner) to review medication orders, laboratory data and other relevant patient information. All decentralized pharmacists are provided with laptops; however they still face significant barriers to decentralization due to functional and size limitations of the laptop. The availability of the iPad in March 2010 provided an alternative device that was lightweight, portable, user-friendly with an extended battery life.

**Methods:** The Pharmacy Department at Boston Children's Hospital purchased 10 units of iPads in Fall 2010 as a pilot to examine the feasibility of including iPads into the pharmacist workflow. Pharmacists who participated in the pilot responded favorably and thus all pharmacists with decentralized pharmacy responsibilities were provided with an iPad. Pharmacists were encouraged to use iPads during decentralization to overcome some of the functional limitations they had experienced with laptops. A user survey was conducted in September 2011 and again in June 2012.

**Results:** The overall response to the iPad was positive. More than 70% of the pharmacist respondents were either extremely or moderately satisfied with their experience with using the iPad on the initial survey and satisfaction rates improved to almost 90% on the June 2012 survey. Pharmacists report that the iPad have allowed for increased mobility, flexibility and connectivity but does not increase efficiency. Tasks that are commonly done on a laptop are ranked to be harder to complete on the iPad. Despite the disadvantages, pharmacists recognize that they are able to attend patient care rounds and make timely interventions more consistently. Almost 70% of the respondents successfully incorporated the iPad into their decentralized workflow and only 1 pharmacist has chosen to forgo use of the iPad.

**Conclusion:** The use of iPads increases pharmacists' mobility and accessibility to other members of multidisciplinary care teams at the point of care. Removing barriers to decentralized pharmacy workflow by increasing mobility also improves pharmacists' satisfaction. Based on the favorable response, the Pharmacy Department at Boston Children's Hospital will continue to support the

use of iPads and will be purchasing a medication management program compatible with the iPad to optimize its usage.

**3-057**

**Category:** Automation / Informatics

**Title:** Continued analysis of smart pump safety software implementation: evaluation of soft and hard limits for medications

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**Purpose:** When Symbiq smart pumps were introduced to UAB Hospital, rate limits were created for medication infusions through a multidisciplinary effort. Limits were determined for each medication entry within the individual clinical care areas (CCAs). The purpose of the smart pumps is to prevent infusion-related errors and enhance patient safety by utilizing software technology and limit alerts. Despite these safety features, historical data shows that more than 60% of the soft alerts are overridden. The purpose of this study is to identify medications that most commonly trigger limit alerts and assess the appropriateness of the current limits.

**Methods:** From October 1st-31st, 2011 all edits and overrides of upper soft and hard limits were identified. Medication entries meeting defined criteria for review were evaluated, and limits were appropriately revised with consultation from Informatics and Drug Information pharmacists. A post implementation analysis occurred March 1st-31st, 2012, 30 days after the library update.

**Results:** During the initial evaluation period 4,250 edits and overrides of upper limits involving 155 medications were documented. Review of the smart pump edits and overrides identified 15 medications which met criteria for further review. Changes to 5 medications were made to enhance pump programming safety and reduce alert fatigue. During the post-implementation review, 3,051 upper limit alerts involving 148 medications were documented. The five medications that experienced changes in the smart pump library (potassium chloride, ondansetron, fluconazole, clindamycin, milrinone) showed a decrease in the amount of soft limit alerts firing between October and March.

**Conclusion:** By regularly reviewing the medications that most commonly trigger limit alerts, these limits can be appropriately revised to maintain safe infusions and reduce alert fatigue.

**3-058**

**Category:** Automation / Informatics

**Title:** Automated computer alerts to improve warfarin prescribing and monitoring among hospitalized patients

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**Purpose:** While anticoagulants are highly effective for an array of conditions, there is growing appreciation of their serious bleeding complications. Due to dosing intricacies, complexity in monitoring efficacy, numerous drug-drug and drug-food interactions, and variable patient adherence, warfarin has consistently been one of the drugs most commonly associated with adverse events. Deficiencies in monitoring are likely to lead to supratherapeutic and subtherapeutic INR levels which lead to increased bleeding and thrombosis, respectively. The intensity of warfarin's anticoagulant effect (i.e., the elevation in INR) is the most important risk factor for intracranial hemorrhage independent of indication for therapy, with intracranial hemorrhage risk increasing as INR exceeds 4.0. Electronic health records (EHR) have been purported by the Institute of Medicine to help improve the quality of care. Past systematic evaluations of computerized reminders and decision support systems have shown improvements in adherence to processes of care.

**Methods:** In 2009, we implemented computer alerts for warfarin monitoring at a large tertiary care academic medical center. These alerts had mandatory stops requiring a response from the clinician to facilitate compliance with the recommended monitoring. We supplemented these alerts with an educational session for residents on proper monitoring of anticoagulants. There were 3 phases of study: Phase 1- alerts fired silently without notification to provider; Phase 2 - alerts fired with notification of providers; and Phase 3 - alerts notifying providers after resident education.

**Results:** We observed a 55% decrease in the proportion of patients with INR>4 when comparing Phase 1 and Phase 3. No significant difference in bleeding episodes could be identified. The firing of alerts decreased in Phases 2 and 3 when compared to Phase 1 (one-tailed proportion test  $p<0.001$ ) even as the number of warfarin orders remained stable. Approximately 33% of computer alerts resulted in the recommended response by the clinician during Phase 2. After completion of resident education (Phase 3), approximately 47% of alerts resulted in the appropriate response.

**Conclusion:** Use of computer alerts embedded in the electronic medical record with mandatory stops is an inexpensive method to improve compliance with anticoagulant monitoring and decrease the rate of supratherapeutic INRs. A single session of resident education demonstrated improvements in provider response to the alerts.

**3-059**

**Category:** Automation / Informatics

**Title:** Pharmacists and technicians receive the medical products storage temperature log in pharmacy automatically by using e-mail system

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**Purpose:** To pharmacists and technicians, to manage medical products is obligatory and suitable management of temperature is also indispensable. So we constructed the system that pharmacists and technicians could receive the storage temperature log of medicines stored in pharmacy through mailing list from personal computer (PC) automatically. The benefit of this system are to ensure accurate and dependable data without error in writing, and also everyone could receive e-mail at the same time and reduce the manpower costs and save time.

**Methods:** The thermostat recorder installed in the refrigerators was set up to record and accumulate the measured temperature for every hour in PC wirelessly. The system was set up by an innovative program which is able to distribute the accumulated thermal data file automatically and periodically as an attached file into PC registered by the mailing list. And this newly constructed system was set up to transmit alarm to PC and a mobile phone when the temperature deviated from the allowance range set in the thermostat recorder.

**Results:** Pharmacists and technicians could receive temperature monitoring report periodically and store the data by e-mail software. By the system, the quality of the medical products required strict temperature control has been managed efficiently.

**Conclusion:** We constructed a system to help a strict temperature control by sending data and through e-mail system automatically. This system enabled pharmacists and/or technicians to reduce the working hours of manual procedures. The proposed system could be constructed without a cost and it will bring the profits to many pharmacies and hospitals.

### 3-060

**Category:** Automation / Informatics

**Title:** Reduction of pharmacy technician dispensing errors through utilization of bar code scanning at the point of delivery to automated dispensing cabinets (BADC)

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**Purpose:** Baystate Medical Center (BMC) is a 653-bed tertiary care, level 1 trauma center and academic teaching institution. It is the flagship hospital of a 3-hospital integrated health system. The inpatient pharmacy department provides pharmacy services 24 hours a day and 7 days a week utilizing a hybrid medication distribution model which includes automated dispensing cabinets (ADC). Prior to October 2010 technicians scanned medications at early points in the dispensing process, however we were unable to reliably ensure the correct medications and doses were dispensed to the ADC. As a result dispensing errors continued to be reported in our safety reporting event system. In October 2010 we began scanning all medications upon delivery to the ADC (BADC) with the goal of attaining a 90 percent technician scan rate.

**Methods:** Safety data including the incidence and severity of medication events was obtained from our online reporting system. Data was evaluated at baseline and post-implementation to demonstrate the impact of scanning at the point of delivery. Dispensing errors are defined as wrong dose or wrong drug dispensed to the ADC. Medication scan rates are defined as the percentage of barcode scans performed on refill transactions to the ADC, relative to total refill transactions. Technician scanning compliance data was collected from ADC reports and evaluated monthly. The pharmacy leadership team used this information to communicate departmental scan rates and establish individual performance expectations.

**Results:** Technician scan rates were 30 percent at baseline and increased to 90 percent over 4 months. Scan rates continued to increase to an average of 93 percent over the following 8 months. Dispensing errors reaching the ADC reported through the online reporting system were reduced by 50 percent (0.4 events per 1000 patient days to 0.2 events per 1000 patient days) during the 12 month study period.

**Conclusion:** The implementation of BADC led to a 50 percent reduction in dispensing errors. BADC ensures the correct medication and dose is loaded into the ADC which is an effective way to reduce dispensing errors. Incorporating scanning compliance into technician annual performance evaluations helped establish accountability.

**3-061**

**Category:** Automation / Informatics

**Title:** Impact of technology on student perceptions in higher learning

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**Purpose:** Many types of technology are available to enhance student learning experiences. Unfortunately, limited data are available addressing the type of technology students own, use, and prefer in their educational experiences. The objectives of this research project are to: inventory the types of technology owned by the McWhorter School of Pharmacy (MSOP) students plus evaluate the usefulness of technology in their learning experiences; and assess the usage patterns and effects of the new lecture-capture system (LCS; Echo-360) in terms of student learning and class attendance.

**Methods:** A 31-question survey was created utilizing [www.kwiksurveys.com](http://www.kwiksurveys.com); some questions were based upon published research. The link to the survey was included in the email inviting all enrolled MSOP students (P1-P4) to participate. Students were informed their participation was voluntary and results were anonymous. The survey was open for 3 weeks with a reminder email sent. A \$25 gift card was awarded to each of five randomly chosen students who completed the survey. Samford University IRB approved this research.

**Results:** The response rate was 42.3% (n = 217 of 506 students). The primary responder demographics were female (75%) between the ages of 19-24 years (59%); all four classes were similarly represented (18-32%). A majority of responders own a laptop (95%) and a smartphone (88%) but only 21% have an iPad. Nearly 83% downloaded Lexi-Comp app and 41% use this on a daily basis; 75% were satisfied with this resource. Although only 48% were aware of and 20% downloaded the university app, 75% would use a MSOP app if available. The frequency of using the LCS recordings among the 75% who access these is 3% daily, 19% weekly, and 59% twice monthly. A majority (66%) rated the LCS recordings as excellent for both enhancing notes and reviewing confusing lecture sections; 65% believed the recordings improved their overall grades while 33% responded the LCS helped them avoid failing an exam and/or course. The LCS did not affect class attendance in 59% but somewhat in 38% of the responders; 1.84% do not attend class on a regular basis since they can watch/listen to the LCS as a substitute. Most students (81%) responded they want to be in class, especially since the LCS does not have same effect as being in class and taking their own notes (47% of responders).

**Conclusion:** Survey results indicate that MSOP students possess and use various forms of technology. Instructors can apply these survey results to revise course activities to include more technology use by students. MSOP students who use LCS recordings rate these as a valuable

addition to learning and do not adversely affect class attendance. The enhanced learning due to LCS recordings obtained from this study are similar to other similar designed studies.

**3-062**

**Category:** Chronic / Managed Care

**Title:** Efficacy of angiotensin-receptor blockade versus converting enzyme inhibition in delaying progression of macroalbuminuria in type two diabetes mellitus

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**Purpose:** Angiotensin II receptor Blockers (ARB) and angiotensin-convertingenzyme (ACE) inhibitors have been used for the treatment of patient with micro- or macroalbuminuria in type two diabetes. However, only few studies have compared the effects of ARB and ACE inhibitors in delaying the progression of nephropathy in persons with type two diabetes. The purpose of this study is to compare the effects of ARB and ACE inhibitors in slowing the decline in creatinine clearance in patients with macroalbuminuria.

**Methods:** The institutional review board approved this retrospective, multicenter, and descriptive study. We followed 100 subjects with type 2 diabetes, hypertension and macroalbuminuria (>300 mg/day) receiving either angiotensin II receptor blocker (51 subjects) or the ACE inhibitor (49subjects) over 24 months. The primary endpoint was the change in creatinine clearance between the baseline value and after 24 months treatment with ARB or ACE inhibitor. The secondary endpoint was the change in urinary albumin excretion rate.

**Results:** The mean CrCl at baseline was 69.27 ml/min and 72.80 ml/min in the ARB and ACE inhibitor group, respectively. After 24 months the change in CrCl was -35.24 ml/min in the ARB group, compared to -35.13 ml/min in the ACE inhibitor group (P=0.471). This indicates that there is no stastically significant difference between ACE inhibitor and ARB in delaying the progression of diabetic nephropathy, measured as the decline in CrCl over a 24 months period. Urinary albumin excretion ratio was 1.60 in the ARB group compared to 2.22 in the ACE inhibitor group, (P=0.162). The urinary albumin excretion rate was 6.6% in the ARB group compared to 9.1% in the ACE inhibitor group. Urinary albumin excretion rate was slower in the ARB group, although it was not statistically significant.

**Conclusion:** There were no differences between ARB and ACE inhibitor in delaying the progression of diabetic nephropathy and in the urinary albumin excretion rate. More multinational studies with larger number of patients are needed to detect the efficacy of ARB over ACE inhibitors in patients with type two diabetes mellitus with macroalbuminuria.

**3-063**

**Category:** Chronic / Managed Care

**Title:** Economic Burden of cardiometabolic disorders associated with commonly-used atypical antipsychotics among patients with schizophrenia in the U.S.

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**Purpose:** The baseline risk of cardiometabolic disorders is high among patients with schizophrenia. Some atypical antipsychotics (AAPs) may further increase this risk. This study aims to estimate the incremental burden of cardiometabolic disorders associated with three of the most commonly-used AAPs, and to quantify their potential overall budgetary impact to a United States (US) managed care plan.

**Methods:** Incremental burden was estimated by predicting the consequences of 6-week cardiometabolic effects with each of the AAPs versus no treatment over a 3-year timeframe. A discrete event simulation model was developed to determine hyperlipidemia, hyperglycemia, and diabetes cases based on cardiometabolic changes at 6 weeks obtained from randomized controlled trials. The model estimated costs (in 2011 values) associated with these events by applying cost data from a nationwide survey of community-dwelling adults with schizophrenia, supplemented with public cost databases (e.g., CMS fee schedules). The overall budgetary impact resulting from the cardiometabolic burden associated with these 3 AAPs was estimated by weighting the economic burden of each AAP based on their market share (i.e., 48% quetiapine, 36% risperidone, and 16% olanzapine) obtained from recent market research. Extensive sensitivity analyses were performed to assess the robustness of the results.

**Results:** Over 3 years per 1000 treated patients, the model predicted 97, 52, and 55 additional cases of diabetes with olanzapine, risperidone, and quetiapine, respectively. Incident cases of hyperglycemia and hyperlipidemia were also much higher with these AAPs than with no treatment, causing additional cost of \$2,534, \$1,215, and \$3,432 per patient, respectively. When adjusted for market share, these treatments resulted in additional 151 hyperglycemia, 73 hyperlipidemia, and 46 diabetes cases, incurring an additional cost of \$2,490 per patient. Assuming that 10,000 patients are treated with these 3 AAPs in a health plan, their cardiometabolic adverse events may cost additional \$25 million over 3 years. The results were sensitive to variations in time horizon and cardiometabolic effects.

**Conclusion:** From this model, the economic burden of cardiometabolic disorders associated with these AAPs was predicted to be substantial. These results suggest the need to consider the safety profile of an AAP when treating patients with schizophrenia.

**3-064**

**Category:** Clinical Service Management

**Title:** Creating a Role for Pharmacy Externs in an Antimicrobial Stewardship Program

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**Purpose:** Primary goals of most antimicrobial stewardship programs (ASP) are to optimize patient outcomes from antibiotic use, reduce the emergence of resistant organisms, and decrease the cost of antibiotic therapy. We studied the impact on antibiotic costs of an ASP which includes a role for pharmacy externs on elective infectious diseases clinical clerkships.

**Methods:** We implemented an elective infectious diseases advanced clinical clerkship for students from a local college of pharmacy in our 41-bed long-term acute-care (LTAC) hospital. A primary function of the pharmacy externs was to monitor all infection-related patient problems in the facility, meet daily with the preceptor and clinical pharmacist, and make recommendations for optimizing antibiotic use. Recommendations were made to the primary care team at least weekly in a multidisciplinary care planning meeting. The effect of this ASP on total antibiotic costs in the facility was measured over two years and compared to baseline.

**Results:** Compared to baseline, total antibiotic costs decreased by 9.4% after the first year, and by 19.0% after the second year.

**Conclusion:** Daily patient monitoring by pharmacy externs on elective infectious diseases advanced clinical clerkships--coupled with daily discussions with the clinical pharmacist and preceptor and regular recommendations to the primary care team--can significantly extend the influence of an ASP. Placing pharmacy externs in this role facilitated a more in-depth assessment of patient progress and outcomes than was previously possible. In our experience, this also appears to have had a measurable effect on antibiotic costs.

**3-065**

**Category:** Clinical Service Management

**Title:** Pharmacy practice change: moving in the right direction

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**Purpose:** Montefiore is a not-for-profit academic medical center comprising of four hospitals in the Bronx, New York and totaling 1400 beds. The principles of the Pharmacy Practice Model Initiative (PPMI) were recently adapted into the routine daily workflow of the pharmacy at two of the campuses, the Moses Division and the Children's Hospital at Montefiore (CHAM). The overall goal was for the staff pharmacists to evolve into more competent and confident clinical practitioners and ultimately to establish an integrated distributive and patient focused model that fosters safe and effective medication use and improves patient outcomes.

**Methods:** Following an inspirational departmental managerial retreat in April 2011 the operational team was determined to devise a strategic plan to incorporate this innovative model into the everyday practice of the department. A number of factors were considered before implementation including staffing and hours of shifts, level of clinical knowledge, practice areas, acceptance of the model change by the pharmacy staff and the perception by the medical teams. An initial task was to establish the time of day when patient focused services can be performed while not disrupting the flow of medication distribution. Differences in education posed a challenge when selecting pharmacists to participate in the model change. Pharmacists currently employed have varied educational backgrounds such as bachelor of science degrees, traditional and nontraditional doctorate degrees and those with one year of residency training. The pharmacists were called upon to assist with selection of the practice areas. It was realized that expanding the responsibilities of technicians, optimizing usage of the current dispensing technology at Montefiore and obtaining wireless computer devices for the pharmacists were essential for a successful transition to the new practice model.

**Results:** An integrated model was developed and proved to be motivating for all involved. As momentum and enthusiasm for the program grew, a sense of contagion to participate in direct patient care occurred amongst the pharmacists that do not typically work outside of the pharmacy walls. Out of 32 fulltime pharmacists, 25 have participated to date. In a seven hour work day, at least two hours are spent performing patient focused assignments. Pharmacists that are decentralized, are involved in direct patient care services for three to four hours per day. Wireless computer devices are utilized to support medication order processing on the care unit. Spear headed by the operational team, periodic meetings were held with the staff pharmacists,

technicians, and clinical managers to adjust workflow, evaluate progress of the program, and to promote staff engagement. Pharmacists benefitted from shadowing the clinical managers during rounds to build their confidence and further develop their abilities to interact with the medical team. Clinical managers provided overview on medication and disease state management. To accommodate patient care rounds and discharge counseling the shift hours were adjusted. The overlap between shifts allowed for more flexibility and wider participation of pharmacists on both day and evening shifts. Areas of practice identified include: cardiac intensive care units, solid organ transplant, pediatrics, immunization and antibiotic stewardship. Pharmacists are involved with quality improvement initiatives such as peer review committee, nursing and pharmacy meetings, and incident case reviews. Patient and family counseling is conducted and documented in the patient health education record.

**Conclusion:** It is apparent that transforming the practice model has made a significant impact on department morale and the provision of direct patient care services. Future goals of this initiative include expansion to more practice areas, incorporation of additional staff, development of training and competency tools, increase opportunities for pharmacists to participate in more medication management roles, and bridge the gap between clinical and distributive pharmacy services.

**3-066**

**Category:** Clinical Service Management

**Title:** Creation of a patient registry to track performance of clinical pharmacy services added to a Hospital Diabetes Self-Management Training/Education Program

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**Purpose:** The increasing rates of chronic disease and the change to a value-based reimbursement system are among the demand and performance forces pressing organizations to take a more proactive approach to patient care. A registry is a list of patients who share some characteristics; such as, a certain condition or medication regimen. Patient registries can help providers manage chronic illness in a proactive, organized fashion and are a key element in collecting and tracking how well providers are meeting treatment goals. Outcomes measured in patient registries can be used to track the impact of clinical interventions on patient improvement as well as identify opportunities for quality improvement in a clinical setting. The purpose of this project was the creation a patient registry to track high-risk patients with diabetes. A clinical pharmacist was added to the patient care team of the hospital DSMT/E program to specifically provide education on the medication component of the program. Prior to the addition of the clinical pharmacist there was no method of tracking the impact of the DSMT/E program on the patients they were educating.

**Methods:** A spreadsheet was developed utilizing Microsoft Excel Spreadsheet. Information collected was classified into three categories: demographic, therapeutic and safety metrics. Over a period of a month, patients with diabetes were screened for inclusion into the patient registry. In order to be included into the patient registry, patients needed to be classified as high risk, which was defined as A1C > 9%, taking greater than six medications or having greater than 5 chronic disease states. Patients were screened as inpatients or from the outpatient pharmacy setting. Once patients agreed to participate in the DSME/T program and physician referral was obtained, patients were added to the registry. Patient specific data collected for the registry were obtained from the hospital health information system or upon request from the physician office.

**Results:** A total of 21 patients were included in the patient registry. The majority of the patients were female (62%). The average age of the patients was of 46 years (41-80 years). Patients had an average of 8 medications and 4 diseases states. Of therapeutic measures the average A1C of the patient population was 10.8% (7.1%-19.1%). Approximately two-thirds of the patient had an A1C >9%. Both the average blood pressure and LDL level were within target goals levels with BP of 131/73 and LDL of 97 mg/dl, respectively. Patients were actively screened for actual and potential Adverse Drug Events. Two (2) actual and 6 potential ADEs were identified during this baseline period.

**Conclusion:** Of those patients that had multiple co-morbidities it is interesting to note that both average BP and LDL levels were below target goals, while A1Cs remained uncontrolled. Creation of a patient registry is a relatively easy and inexpensive way to start tracking health and safety outcomes of a specific population of patients. Utilization of patient registries is new approach to managing patients by hospitals or physician practices as payment models shift to pay for performance structure. Patient registries can also be utilized by pharmacy departments or clinical pharmacists practicing in various settings as a tool for quality improvement. This registry provided valuable information that will help to guide efforts of the team moving forward.

**3-067**

**Category:** Clinical Service Management

**Title:** Development and implementation of a vancomycin collaborative practice agreement at a community hospital

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**Purpose:** The clinical pharmacist has become a valuable member of the healthcare team and a valued resource to physicians. Quality patient care is best achieved with communication, collaboration and recommendation between pharmacist and prescriber. Vancomycin is a drug frequently used in clinical practice today. The pharmacist can improve the dosing, monitoring and adjustment of vancomycin therapy. A collaborative practice agreement (CPA) was developed and implemented at Intermountain Healthcare LDS Hospital, a 213 bed community based hospital in Salt Lake City, Utah. With the use of this CPA pharmacist have the ability to dose, monitor, and adjust vancomycin therapy within criteria and guidelines set forth in the CPA. This CPA has enhanced the quality of patient care and improved the clinical use of vancomycin therapy.

**Methods:** Current vancomycin use in clinical practice was evaluated. Primary and tertiary literature was reviewed. Criteria for vancomycin use was developed within pharmacist, pharmacist and physician groups. The CPA was approved by the Pharmacy and Therapeutic Committee. The local Medical Executive Committee at LDS Hospital also approved the CPA. Each pharmacist participated in the CPA education module and competency exam. The CPA addressed vancomycin initiation procedure, dosing, hemodialysis, concentration, infusion rate, monitoring, dosing adjustment, and physician notification. The physician initiated the CPA with a written order in the patients chart. The pharmacist then followed the CPA to provide initial dosing, filling out the initial vancomycin order form, and placement in the chart. The pharmacist provided a electronic vancomycin pharmacy note at CPA initiation and daily thereafter. Key points of the CPA were: vancomycin trough goal of 15-20 mcg/ml, weight based loading and maintenance dosing, and a renal function algorithm. The physician was notified when the vancomycin trough exceeded 30 mcg/ml, the serum creatinine increased greater then 50 percent, there was an adverse reaction to vancomycin, and with pertinent microbiology information. The frequency of prescribers' use of the CPA before and after its implementation on a medical unit was measured. Additionally the mean initial vancomycin trough concentration of pharmacist and physician-dosed patients were compared.

**Results:** The vancomycin CPA was initiated on April 1, 2012. Nineteen pharmacists participated in the vancomycin CPA education module and passed the competency exam. During the first two months after implementation, 50 patients were placed on vancomycin therapy. Prescribers used the CPA on 40 of 50 patients (80%), and 10 (20%) were managed by prescriber only. This compares to a one month period prior to implementation of the CPA when 13 out of 20 patients (65%) were managed by pharmacist and 7 (35%) were managed by prescribers only. Average initial vancomycin trough values from CPA and physician-dosed patients were 15.79 mcg/ml and 14.65 mcg/ml respectively.

**Conclusion:** A vancomycin CPA has been successfully developed and initiated at LDS Hospital. It has provided a tool to enhance communication, patient care, and enabled the pharmacist to gain an enhanced role in the hospital.

**3-068**

**Category:** Clinical Service Management

**Title:** Impact of a Pharmacist on HCAHPS Performance Measures

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**Purpose:** To evaluate the effect of pharmacist consultation on the HCAHPS score regarding communication about medicines

**Methods:** From January to September 2011, 56% patients surveyed at our institution answered that staff "always" explained about their new medicines, when compared to the national average during same period of 61% (31st percentile). Standard practice at our hospital is that the nursing staff provides information about medications to patients during hospital stay and at discharge, with exception of high risk drugs, such as anticoagulants. Intervention included pharmacist consultations to patients located on a medical/surgical nursing unit (Study Unit, 2W vs. Control Unit, 3N). Newly admitted patients were screened using a daily census. Medication consultations were provided to mentally alert and oriented patients within 24-48 hours of hospital admission. Prior to consultation, the pharmacist reviewed the home and current inpatient medication therapies. The patient was provided with written and verbal information focusing on indications and common side effects of their prescribed medications. Written handout was developed during the intervention period to assist with teaching and to serve as a visual reminder of pharmacist consultation. Written handout includes: Commonly prescribed medications; indications for medication use; and common side effects

**Results:** During the intervention period of October 2011 to February 2012, there were 193 total consultations performed (46% of patients admitted during this time period). Mean age of patients consulted was 51 +/- 19 years; 61% of the patients were females. The average number of patient's home and inpatient medications were 6 and 9, respectively. When compared to the control unit (n=38), the intervention unit (n=180) demonstrated a 7% increase in the number of patients who responded as "always" received communication about their medicines, 63rd and 81st percentiles, respectively.

**Conclusion:** HCAHPS scores measure patients perception of the quality of their hospital stay, including communication about medicines. Pharmacists can play an important role in improving patients knowledge of their medicines, potentially translating to increase in HCAHPS scores

**3-069**

**Category:** Clinical Service Management

**Title:** Implementation of the pharmacy practice model initiative (PPMI) in a community hospital and the pharmacists role in heart failure hospital quality measures and readmission rates

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**Purpose:** At Hillcrest Hospital, the pharmacists have been the primary caregiver responsible for patient education and medication related hospital quality measures for Acute Myocardial Infarction and Heart Failure since 2004. The process has been accomplished with a small group of trained pharmacists with one being scheduled during each week day. In response to a growing desire for additional pharmacist involvement for other quality and patient satisfaction initiatives, a decision was made to decentralize these responsibilities to five pharmacists each day including weekends as part of a practice model initiative and without an increase in budgeted positions. The purpose of this project was to evaluate the effect of the change in practice model on heart failure hospital quality measures and readmission rates.

**Methods:** The practice model change occurred on October 1, 2011. The data collection period included the third quarter 2011 (pre-practice model change) and fourth quarter 2011 (post-practice model change). Data collection included hospital quality measure discharge education measure (HF-1); number of heart failure education completed but were not included as a quality measure patient; total number of patient education completed; and 30-day readmission rate after primary admission for heart failure.

**Results:** In the 3rd Quarter, there were 132 patients included for heart failure quality measures as compared to 142 patients in 4th Quarter 2011. For quality measure HF-1 complete discharge instructions was 97/99 (97.9%) for 3rd Quarter and 105/106 (99.1%) for 4th Quarter. An additional 15 and 30 quality measure patients were counseled during the pre- and post-practice model change respectively that were not counted towards HF-1 measure. Overall, 234 patients were educated by a pharmacist in the previous model as compared to 669 patients in the new model. The 30-day readmission rate following the indexed heart failure admission was 17.4% for the 3rd Quarter and 24.7% for the 4th Quarter.

**Conclusion:** The implementation of the pharmacy practice model in a community hospital provided additional patient education opportunities by pharmacists and without an increase in budgeted positions. Previous hospital quality measure responsibilities were maintained with a small improvement. Despite the education of more patients in the new model, this did not reflect in a reduction in the 30-day readmission rates.

**3-070**

**Category:** Clinical Service Management

**Title:** Assessment of the 4 Ts scoring system to predict the likelihood of positive antibody-titer for heparin-induced thrombocytopenia (HIT) as a screening tool in adult inpatients in a community hospital

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**Purpose:** To assess the usefulness of the 4 Ts scoring system to predict the likelihood of positive antibody-titer for HIT as a screening tool in adult inpatients in a community hospital.

**Methods:** Heparin-induced thrombocytopenia (HIT) is an antibody-mediated paradoxical adverse effect of exposure to unfractionated- (UFH), and low-molecular weight heparin (LMWH) with a high risk of life- or limb-threatening thrombosis. The incidence of HIT is about 1 percent in patients receiving UFH and 0.1- 0.5 percent in patients receiving LMWH. HIT is a clinicopathologic syndrome as the diagnosis is based on the combination of a reasonable clinical opinion and the presence of platelet-activating heparin anti-PF4 antibodies. Clinical prediction rules such as the 4Ts scoring system have been developed to assist the physicians with determining the probability that a patient has HIT. We used the HIT antibody titer results as a predictor of HIT itself, though the ELISA method (PF4-IgG/IgM/IgA with more than 0.4 titer values considered positive) we used is not a confirmatory test. We used this test as the turn-around time was quicker than a confirmatory test such as serotonin release assay. The CHEST guidelines from the American College of Chest Physicians published in February 2012 have offered this scoring system as a tool to evaluate the continued use of heparin products when HIT is suspected. The 4 Ts scoring system involves an evaluation of the degree and timing of thrombocytopenia, presence of thrombosis or other clinical sequelae, and other causes of thrombocytopenia including the concomitant use of sulfa antibiotics, vancomycin and recent surgery or sepsis, etc. per guidelines. The objective of this study was to assess the usefulness of the 4Ts scoring system to predict the occurrence of positive HIT antibody titer as a predictor of HIT and as a quick screening tool in our 220-bed community hospital. This retrospective chart review study consisted of all the 72 patients (34 males, 38 females, mean age 67 years (plus/minus standard deviation 17-range 29-96 years) who had HIT antibody titers available from February 2010 through May 2012. Per guidelines, a score of 0-2 was assigned for each one of the 4Ts. We tallied the 4Ts score and assigned the prediction of HIT as: unlikely for a score of 1-3, probably for a score of 4-5, and likely for a score of 6-8. Three of our physicians reviewed the scoring system used. We used Microsoft Excel to calculate the mean and percentage of

patients in each one of the categories. Using standard equations, we calculated the negative predictive value of the 4Ts scoring system, as the number of patients in the unlikely HIT-scoring (low score) category with negative HIT-antibody titers was the most. We combined the categories of probably (intermediate score) and likely (high score) to compare with unlikely category results for this calculation. In this study, we did not include the cost impact of HIT antibody titers ordered and other anticoagulants that may have been used for these 72 patients after the initial heparin products were discontinued. This study was exempt from the Institutional Review Board approval as a retrospective study.

**Results:** In this study, the 4Ts scoring system predictions for HIT were: unlikely in 47 of 72 (65.3 percent), probably in 19 of 72 (26.4 percent), and likely in 6 of 72 (8.3 percent) patients. Of the 47 patients in the HIT-unlikely category, 43 had negative HIT-antibody titers (91.5 percent). Five of the 19 patients (26.3 percent) in the HIT-probable category, and 5 of 6 patients (83.3 percent) in the HIT-likely category had positive HIT-antibody titers. We combined the number of patients in the probably (19) and likely (5) HIT categories to compare against the unlikely (47) categories to figure a negative predictive value of the 4Ts scoring system of 92 percent. As there were only 6 likely-category patients out of 72, the positive titer results achieved in 5 of them may have to be evaluated further and confirmed in a larger population to make reasonable predictions.

**Conclusion:** Overall, the 4Ts scoring system did not seem to be useful for predicting positive HIT antibody titer as the number of patients with positive titers was too small to make any claim. However, it appears to be very useful as an initial screening tool in predicting the unlikely occurrence of HIT. This tool may also help the physicians decide to continue heparin products before initiating expensive alternatives such as direct thrombin inhibitors and ordering HIT-antibody titers for all thrombocytopenia scenarios. However, as the negative antibody titer results may not necessarily correlate with clinical HIT, the diagnosis of HIT needs to be based on clinical impression in conjunction with the confirmatory HIT-antibody titer results.

**3-071**

**Category:** Clinical Service Management

**Title:** Impact on pharmacist interventions by implementing pharmacy practice model changes

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**Purpose:** Consistent with the recommendations of American Society of Health-System Pharmacists (ASHP) 2010 Pharmacy Practice Model Initiative (PPMI), each pharmacist at a 616 bed tertiary care hospital has shared responsibility for the clinical and drug preparation/distributive services of the pharmacy department. The purpose of this study is to show the impact of pharmacy practice model changes on the number of pharmacists' interventions.

**Methods:** Documentation of pharmacist services or interventions was collected over two 6-month time periods. The pharmacy practice model changes took place in February of 2011. Data from July to December 2010 was utilized as the baseline measure; July to December 2011 data was chosen to compare after changes in the in the practice model. Two practice model changes were implemented. The process of pharmacist verification of drug orders was transferred from two centralized locations to decentralized pharmacists on the patient care units. Decentralized pharmacists have greater ability to directly address issues related to drug prescribing with the healthcare team. The other change was to expand the decentralized staffing on weekdays on second shift (1500-2300) by reassigning pharmacists from the central and satellite pharmacies. This was done in an effort to increase the amount of time provided for unit-based pharmacy services and to even out the staffing based on workload distribution between shifts. Utilizing available staff, a satellite pharmacy was closed and the number of pharmacists staffing in the main pharmacy was reduced. The ten decentralized pharmacists working first shift (0700-1500) remained the same. Four positions on second shift (1500-2300) were introduced.

**Results:** Overall, there was a 21.6% increase in interventions, from an average of 5393 to 6965 interventions per month. The greatest change in pharmacist activity was during the second shift with increases of 49.2% in documented interventions and 37.2% in estimated cost avoidance. Types of interventions/services included parenteral to oral dosage form changes, dose recommendations, pharmacy consult services, detection of medication history errors, patient medication education, drug information to other healthcare providers, and avoidance of drug duplication and significant drug interactions. Based upon pharmacist feedback and to provide further improvement, shift overlap from first to second was increased from one to two hours on select units to address workload and provide cross coverage for order verification during critical care rounds and breaks.

**Conclusion:** Utilizing existing staff to provide unit-based pharmacy order verification and extending the hours of decentralized pharmacy services resulted in a significant increase in documented clinical interventions. Through the implementation of these pharmacy practice model changes, the pharmacy department was able increase patient-centered care through greater participation by unit-based pharmacists in the processing of drug orders.

3-072

**Category:** Drug Information

**Title:** Bioterrorism drill collaboration between drug information centers and the Alabama Department of Public Health

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**Purpose:** To test the response capabilities of drug information (DI) / Poison Control Center personnel and systems in the event that a mass prophylaxis was required from patients who received medications dispensed by the Alabama Department of Public Health.

**Methods:** Participants from two DI Centers and one Poison Control Center were included. Scenarios (n equals 8) were developed in which patients had questions regarding ciprofloxacin and doxycycline in response to anthrax exposure. Role players (n equals 17) were provided the scenarios and a toll-free number to call which was created to rotate between sites. Personnel at DI / Poison Control Centers responded to requests for over 45 minutes on December 13, 2011. Evaluators at the sites provided feedback on the exercise to determine strengths and weakness of the current system.

**Results:** Role players placed 555 calls into the system with 69 connecting for a 12.4 percent success rate. Calls not successfully connected were routed to DI / Poison Control Center voicemail or main telephone operator functions. Time spent on each connected call was typically 2 to 5 minutes.

**Conclusion:** The drug information call center drill demonstrated the call centers have the staff capable to answer questions and the emergency response phone line does rotate as designed between centers; however, infrastructure can be overwhelmed with a high call volume. Future exercises should evaluate improvements in infrastructure, a staggered call start, incorporation of social media, and considerations to the actual call volume in response to an event.

**3-073**

**Category:** Drug Information

**Title:** Assessment of attitudes toward the iPad and patterns of use among pharmacy faculty members

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**Purpose:** Over 140,000 applications are available for the iPad, which can provide almost limitless opportunities for innovation in the academic setting. Based upon historical trends with other technology (i.e., personal digital assistants, etc.) it can be expected that tablet computing and associated technologies will be more fully utilized by faculty and students in colleges of pharmacy. In August 2011, Samford University McWhorter School of Pharmacy (MSOP) provided all full-time faculty members with 32 GB iPad 2 devices with WiFi capability. The purpose of this study was to assess faculty attitudes regarding the iPad and patterns of faculty iPad use over a 7-month period.

**Methods:** All full-time faculty members of MSOP were invited to participate (n equals 42). A 21-item pre-exposure survey was developed. Questions 1-2 obtained demographic information, questions 3-8 assessed baseline knowledge of iPads, questions 9-12 and 17-21 assessed attitudes toward iPads and questions 13-16 assessed the perceived utility of the iPad. Survey items assessing faculty attitudes were Likert scale variables, whereas other survey items were categorical variables. The survey was distributed twice during the 2011-2012 academic year. The pre-exposure survey was distributed at the August 2011 faculty meeting and the 7-month, post-exposure survey was distributed at the March 2012 faculty meeting. Both surveys were identical with the exception of demographic information being excluded on the post-exposure survey. To allow for a paired analysis, faculty listed the last 5 digits of their personal university identification number as a unique, anonymous identifier. Faculty were sent a reminder email to complete either survey if they were absent from the faculty meeting. This research was approved by the Samford University IRB.

**Results:** Of the 42 full-time faculty members, 100 percent completed the pre-exposure survey and 62 percent (n equals 26) completed the post-exposure survey. Only data sets of faculty members who completed both the pre-exposure and post-exposure survey were analyzed for this project. Faculty from the pharmacy practice department and the pharmaceutical, social and administrative science department completed the pre- and post-survey at rates of 77 percent and 23 percent, respectively. Regarding faculty attitudes, median scores indicate that faculty members agreed that the iPad increased productivity related to administrative duties and school service responsibilities, respectively. Alternatively, 54 percent disagreed or strongly disagreed that the iPad assisted with productivity in didactic teaching. Additionally, 40 percent of faculty

with experiential sites disagreed or strongly disagreed that the iPad assisted with on-site productivity. Primary uses of the iPad among responding faculty members were email (62 percent) followed by internet browsing (54 percent). Overall, 54 percent of the respondents indicated that they used the iPad less for work-related purposes than they anticipated.

**Conclusion:** In comparison to pre-exposure survey results, post-exposure survey results indicate that the iPad did not meet the expectations of being a useful tool for didactic or experiential teaching among this sample of college of pharmacy faculty members. Further training on effective use of the iPad in the classroom and experiential setting is warranted as faculty members agreed on both the pre- and post-exposure surveys that they would like more training on academic use of the iPad.

**3-074**

**Category:** Drug Information

**Title:** Creation of a peer reviewed drug information frequently asked questions database for internal use in a health care system pharmacy

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**Purpose:** The Drug Information (DI) Center at a large, academic health care system receives questions from physicians, nurses, and pharmacists. The questions and answers from the past 11 years are stored in an internal database only assessable by the DI staff. This project was developed to provide concise information about questions and answers that are frequently asked, pertain to hospital specific clinical practice, information often required in emergent situations, and information not readily available. The database is intended to be accessed only by pharmacists employed by the health care system.

**Methods:** An assessment was completed within the pharmacy department to evaluate the amount of pharmacist time spent answering DI questions and the types of questions answered. Based on these results, the DI staff made a list of questions to be developed into a database created by the pharmacy information systems team. Previous DI responses were assessed and updated with current information in tertiary sources and primary literature, as applicable. All answers were written in a concise format and include references and dates of when the answers were originally created and last updated. Each response underwent an initial peer review process by two DI pharmacists before it was released to be active in the database. All DI responses were given internal numbers for indexing and are in an annual rotation to be reviewed and updated with new information. Education was provided to pharmacists on how to utilize the database.

**Results:** On average, a pharmacist spends 2.5 hours per day answering DI questions that require five to fifteen minutes of research for each question. The DI Frequently Asked Questions (FAQ) Database was created by the DI staff and made available to pharmacists once more than fifty responses were finalized. Use of the database decreases research time by both pharmacists and DI staff and allows pharmacists to relay similar information to all requestors. Questions continue to be added to the database as they are recommended by pharmacists.

**Conclusion:** A DI FAQ Database was created for internal pharmacy use. It provides current responses about information not readily available, hospital specific clinical practice, information needed in an emergent situation, and questions commonly asked to the DI staff. The database is utilized often by the drug information staff and pharmacists and has assisted in decreasing pharmacists workload in researching specific drug information requests.

3-075

**Category:** Drug Information

**Title:** Trends in drug recalls in pharmaceutical manufacturers in Japan

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**Purpose:** An increasing number of drug recalls in pharmaceutical manufacturers leads to difficulty in supplying medications. The aim of this study was to investigate the drug recalls in Japan and to assess their influence on medication in clinical practices.

**Methods:** Drug recalls of class II and III from April 2008 to March 2011 were searched using the website of Pharmaceuticals and Medical Devices Agency. Each recall was classified according to the dosage form, drug effect, brands or generics, and recall reasons. Influence of the recall on medications was also assessed in Hamamatsu University Hospital (HUH).

**Results:** One hundred twenty-eight recalls were observed in the investigated period in Japan. As for the dosage forms, the number of internal medicines, external one and injections were 67, 13 and 48, respectively. The number of brands, generics and the others were 60, 56 and 12, respectively. The number of central nervous system medicines, cardiovascular one, metabolic disease one and the others were 20, 15, 14, and 79, respectively. As for the recall reasons, the number of deviation from approved standard, mislabeling, contamination or alteration, regulation breach and the others were 40, 25, 23, 18 and 22, respectively. In HUH, 33 products were subject to the recall drug and 7 products were the recall lot. One drug recall led to difficulty in continuing medications.

**Conclusion:** The drug recalls were observed in every drug category, and the majority had difficulty in being found in hospital settings. The drug recall can affect the medications in clinical practices.

3-076

**Category:** Drug Information

**Title:** Chronic obstructive pulmonary disease (COPD): inhalation technique and information about drug treatment effects - a task for clinical pharmacists?

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**Purpose:** Ensuring an optimal therapeutic effect of inhalation medication requires a proper inhalation technique and knowledge of drug treatment effects. The aim of this study was to assess the inhalation technique and general knowledge of the treatment effects in a group of patients with stable COPD. The study was conducted by a clinical pharmacist on the Medical Cardiology Section at OUH Svendborg Hospital.

**Methods:** Over a five week period a clinical pharmacist reviewed the use of inhalation medication in a selected group of hospitalized patients. This group included only patients already receiving a stable medical treatment for COPD, but allowed the patients to use a variety of different inhalation devices. Data collection consisted of two parts, an observational study and interviews. The observational study aimed to assess the patients inhalation technique, where five process steps were observed; step one: proper dosage preparing, step two: exhale before inhalation, step three: inhaled dose by correctly placed mouthpiece and holding head in an upright position, step four: device is taken out of mouth before expiration and step five: the patient holds breath for a few seconds after the inhaled dose. The patient interviews aimed to assess drug treatment knowledge focusing on the following three issues: how fast should the patient feel the effects of the medication, how long should the effect of the medication last and what are the side effects of the medication. Patients were also asked if they used mouthwash after inhalation and whether or not they followed physicians prescription.

**Results:** The study involved 28 patients (n equals 28). The data from the observational study showed that 93 percent (n equals 26) of all the patients had between one and four errors in their inhalation technique. The remaining 7 percent (n equals 2) of the patients had no errors. 25 percent (n equals 7) failed process step one; 64 percent (n equals 18) failed process step two; 36 percent (n equals 10) failed process step three; 18 percent (n equals 5) failed process step four, and 68 percent (n equals 19) failed process step five. The data collected from the interviews showed that: On average 2.5 inhalation device systems were applied per patient. Inhalation treatment consisted of the typical drugs recommended (Global Initiative for Chronic Obstructive Lung Disease guidelines) for the treatment of COPD. 89 percent of patients (n equals 25) had no knowledge about the expected effect of the applied medicine. 36 percent of the patients (n equals 10) did not routinely use mouthwash following inhalation treatment. 36 percent of the patients (n

equals 10) experienced side effects such as oral thrush or a dry mouth. 25 percent of the patients (n equals 7) regulated the dose of medication, without consulting their physician first.

**Conclusion:** The study showed that the vast majority patients did not use their inhalation devices correctly and had an insufficient knowledge of drug treatment effects. Multiple patients regulated the dose of medication and appeared non-compliant. The study indicates a need for increased focus on inhalation technique as well as a need for patient information regarding drug treatment effects. This is an obvious area where the clinical pharmacists can play an important role in ensuring patient treatment compliance in conjunction with other health care professionals in the hospitals.

3-077

**Category:** Drug-Use Evaluation

**Title:** Meperidine medication use evaluation for 2 to 3 days of therapy

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**Purpose:** Purpose: The purpose of this Medication Use Evaluation is to determine the appropriate use of Meperidine for 2 to 3 days of therapy. The institutional recommendation is for meperidine to be used for up to 3 days of therapy. The institution is a 161-bed acute care hospital, serving a population of approximately 200,000 residents and services include womens health, diagnostic, medical, surgical, and geriatric behavioral health services. Meperidine hydrochloride is a synthetic opiate, which is transformed into an active metabolite named normeperidine. Accumulation of the active metabolite, normeperidine, will occur after repeated and/or elevated doses in patients with renal impairment. The half-life of normeperidine is significantly longer (15X30 hours) than that of the parent drug and is further increased in patients with renal dysfunction (> 30 hours). Meperidine is recommended as second line short term therapy for the treatment of acute moderate to severe pain in patients who have a documented hypersensitivity to morphine or hydromorphone, intolerance to other opioid analgesics, and treatment failures with other first-line opioids.

**Methods:** Methods: A utilization report was generated for patients who received meperidine from February 2011 to January 2012. A retrospective chart and electronic profile review and analysis were conducted on selected patients who received meperidine within this time frame. A total of 95 patients received meperidine in the 12 month period and 86 patients (91 percent) were selected for the Medication Use Evaluation (MUE) data collection analysis. The exclusion criteria were one time dose, ER patients (not admitted), and orders that were less than 24 hours. Inclusion criteria included meperidine orders that were on patients profiles for 24 hours or longer and those that received a one time dose more than 5 times in 24 hours. The primary outcome measures were number of patients who received meperidine as a first line agent and those over age 65. Secondary outcome measures included patients that were on meperidine therapy for greater than 72 hours and the indications for this use.

**Results:** Results: The study population consisted of 79 percent female and 21 percent male. The patients age ranged from 14 to 87 years (mean of 43.29 years, SD = 16.93) and 8.1% (7 patients) were over 65 years. Sixty nine patients (80.2 %,  $p < 0.0018$ ) received meperidine as a first line agent while seventeen patients (19.8%) received meperidine as a second line agent for documented allergies (2 were prescribed meperidine after they developed postoperative

shivering, 8 had documented allergies, and 7 had hypersensitivity to morphine or codeine). The average dosing regimen for the study group was 45mg every 4 hours. Eight patients (9.3%) had Cr clearance less than 50mL/minute with duration of therapy ranging from 24 to 72 hours and mean of 68 years. All the patients over age 65 were on meperidine therapy for less than 72 hours with an average of 6 doses (range of 2 to 9 doses). The lengths of therapy for the study population were as follows: 46.5 % for 24 hours; 19.8% for 48 hours; 17.4% for 72 hours; and 16.3% (14 of 86 patients) were over 72 hours. Thirteen of those over 72 hours had an average of 19 doses (range of 2 to 38 doses) and one outlier was a patient with Crohns disease, multiple fistula and abscesses (allergic for morphine) who had 142 doses over 408 hours (17 days). Indications for the study group were as follows: 20 percent were pregnant women, 31 percent had other surgical procedures done, and 49 percent were pain management. The indications for those over 72 hours were all surgical except for one migraine patient.

**Conclusion:** Conclusions: Meperidine has a high potency of causing neurotoxicity, especially in elderly patients and renal dysfunction patients. The accumulation of the active metabolite normeperidine can lead to CNS events. Eighty four percent (72 of 86 patients) of the study population received meperidine therapy for less than 3 days, while 16% (14 patients) received therapy over 3 days. Eight percent of the study population were over the age of 65 and received meperidine therapy for less than 3 days. There were no documented meperidine related adverse reactions. The institution decided to maintain meperidine on the formulary because 19% percent of patients needed meperidine due to documented allergies, 84% received meperidine therapy for less than 3 days, and will further restrict the use of meperidine as a first line agent in patients without documented allergies.

**3-078**

**Category:** Drug-Use Evaluation

**Title:** Evaluation of the appropriateness of dabigatran use and follow-up events

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**Purpose:** Anticoagulation is a vital component of the management of atrial fibrillation (AF). Warfarin has been the long standing modality for the prevention of stroke and systemic embolism in patients with AF; however, frequent monitoring and drug and food interactions complicate its use. Dabigatran, the first, oral direct thrombin inhibitor indicated for the prevention of stroke and systemic embolism in patients with nonvalvular AF, provides an alternative to warfarin. At Robert Wood Johnson University Hospital (RWJUH), dabigatran has been used since January 2011. However, due to the lack of efficacy and safety data, any order of dabigatran 75 mg twice daily must be approved by the Chair of P&T and/or Pharmacy Administration. This approval process can be time consuming. The primary objective of this study is to evaluate the appropriateness of dabigatran use at RWJUH and evaluate the necessity of the 75 mg order approval process. A secondary objective of this study is to identify any subsequent admissions that may be attributable to the use of dabigatran.

**Methods:** This study was approved by the Institutional Review Board prior to initiation. Patients were identified via the hospital-wide electronic medical record system (Sunrise Clinical Manager). All patients receiving at least one dose of dabigatran during the time period of January 1, 2011 to December 31, 2011 were included in the study. The following data was collected via a retrospective chart review: patient demographics, indication and characteristics of dabigatran use, length of stay in the hospital, and any subsequent admissions due to either a thromboembolic or bleeding event within the study time period. Appropriateness of orders was based on recommended dosing in the dabigatran prescribing information.

**Results:** A total of 392 orders of dabigatran were collected and 357 orders were included in the final analysis. The mean age of the patient population was 69 years (18-99) and 160 (45%) patients were on dabigatran prior to admission. The majority of dabigatran orders (n=309) were for 150 mg twice daily and only 48 orders were for 75 mg twice daily. Of the 150 mg orders, 280 (91%) were in patients with a creatinine clearance (CrCl) >50 mL/min, 26 (8%) were in patients with a CrCl 30 - 50 mL/min and 3 (1%) were in patients with a CrCl 15 - 30 mL/min. Of the 75 mg orders, 18 (37%) were in patients with a CrCl >50 mL/min, 11 (23%) were in patients with a CrCl 30 - 50 mL/min, 10 (21%) were in patients with a CrCl 15 - 30 mL/min and 9 (19%) were in patients with a CrCl <15 mL/min. Overall, 315 (88%) and 33 (9%) dabigatran orders were deemed appropriate and inappropriate, respectively. The reasons for inappropriate orders were as follows: under-dosing with 75 mg (n=18), patients with a CrCl <15 mL/min receiving dabigatran (n=9), unapproved indication (n=3), and over-dosing with 150 mg (n=3). Moreover, 9 orders

were considered controversial, as they were technically correct based on recommended dosing, but the clinical situation may have warranted a different dose of dabigatran. There were 22 subsequent admissions attributed to the use of dabigatran, the most common cause being gastrointestinal bleeding (n=10) following by stroke (n=8). The patient population with a CrCl 30 - 50 mL/min experienced the highest frequency of admissions due to dabigatran.

**Conclusion:** The majority of dabigatran orders were appropriate and this may be attributed to pharmacy involvement and the approval process for 75 mg orders. The success of the approval process and ongoing pharmacist and physician education since dabigatran's addition to formulary has increased the comfort level of both pharmacists and physicians when using dabigatran. This increased knowledge and comfort level will eliminate the need for the approval process and will allow pharmacists to serve as the final check for dabigatran 75 mg orders and, if necessary, work with prescribers to ensure proper therapy. Inappropriate orders were predominantly due to under-dosing patients with a normal CrCl. The patient population with a CrCl 30 - 50 mL/min experienced the most admissions secondary to dabigatran use and the most common cause of admission was GI bleeding.

**3-079**

**Category:** Drug-Use Evaluation

**Title:** Clinical and economic evaluation of Rivaroxaban for prophylaxis of venous thromboembolism in patients undergoing total hip or knee replacement surgery with implications for the MassHealth budget

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**Purpose:** DVT prophylaxis is an important measure for prevention of blood clots in patients who are undergoing hip or knee replacement surgery. However, the most common anticoagulants used for this purpose have prominent drawbacks: warfarin requires intensive INR monitoring and dose adjustments, and enoxaparins subcutaneous formulation may cause non-compliance among patients leading to recurrent thrombotic events. Rivaroxaban (Xarelto) is a revolutionary oral anti-Xa inhibitor that has the potential to be more economical than current standards of care. It is currently approved for the use as prophylaxis of deep vein thrombosis (DVT) and pulmonary embolism (PE) in patients who have undergone knee or hip replacement surgery and to reduce the risk of stroke and systemic embolism in patients with nonvalvular atrial fibrillation. Little is known about how cost-effective of rivaroxaban compared to current standards of care and the impact of rivaroxaban on a payers perspective in order to address the potential savings of this drug. This project is designed to conduct a clinical and economic evaluation regarding the use of rivaroxaban for the prevention of deep vein thrombosis and to estimate the budget impact of rivaroxaban from a MassHealth perspective.

**Methods:** A systematic literature search was conducted in PubMed on the clinical and economic impact of rivaroxaban. The MassHealth estimated budget costs included drug costs in WAC, INR testing and monitoring, anticoagulation monitoring service (AMS) run by pharmacist, and pharmacogenomic testing per sample. We assumed the costs of adverse events associated with enoxaparin, warfarin, and rivaroxaban to be similar since the incidence of bleeding was found to be similar in our included clinical trials. For the sensitivity analyses, included the highest, average, and lowest value of INR monitoring and AMS run by pharmacists. Pharmacogenomic testing was included in one scenario.

**Results:** A total of 404 clinical studies and 187 economic studies were initially identified. Only four clinical and three economic studies regarding the efficacy, safety, and cost-effectiveness of rivaroxaban met the criteria for inclusion in this analysis. These articles compared rivaroxaban to the common anticoagulants used in DVT prophylaxis -- warfarin and enoxaparin. Trials directly

comparing rivaroxaban and warfarin were not available at the time the analysis was conducted, so we utilized data from studies that compared enoxaparin and warfarin as surrogates as required. Based on the clinical trials, rivaroxaban is found to be more effective compared to enoxaparin and does not have increased incidence of bleeding events. It is also more cost saving compared to enoxaparin and warfarin. One cost saving aspect of rivaroxaban is that it does not require monitoring unlike warfarin. When switching from warfarin to rivaroxaban, we estimated that MassHealth would save around \$208.94 and \$350.69 per patient for a 35-day course of prophylaxis after hip and 14-day course of prophylaxis after knee replacement, respectively, after accounting for monitoring costs associated with warfarin. Furthermore, switching from enoxaparin to rivaroxaban can save as much as \$1,267 and \$1,409 for a 35-day course of prophylaxis after hip and 14-day course of prophylaxis after knee replacement, respectively. Based on the results from the sensitivity analysis, we found the savings strategy by replacing warfarin with rivaroxaban is not sensitive to possible increase in the WAC of rivaroxaban across scenarios. However, in the worst case scenario for hip replacement, the saving strategy is sensitive to possible increase in WAC of rivaroxaban and switching from warfarin to rivaroxaban in this case would cost more (\$67.84 per patient).

**Conclusion:** Based on the findings, rivaroxaban appears to be more effective and cost saving than warfarin and enoxaparin in preventing the venous thromboembolism after hip or knee replacement surgery. Its unique formulation, once daily dosing and lack of stringent monitoring could make it a more attractive choice to patients needing prophylactic therapy who would have difficulty adhering to changing warfarin dose schedules, INR testing, and those who would have difficulty with self injections. However, the data regarding the bleeding rates are still lacking and more observational studies are needed in order to evaluate the true clinical and adverse effects of rivaroxaban. Clinicians need to be well-informed regarding a possible increase bleeding risk with rivaroxaban and unlike warfarin; there is no specific antidote available for rivaroxaban reversal in case of severe bleeding.

**3-080**

**Category:** Drug-Use Evaluation

**Title:** Assessing benzodiazepines use and dispensing procedures in a Lebanese community pharmacy

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**Purpose:** The objective of the study was to assess the use of Benzodiazepines in Lebanese outpatient subjects and evaluate benzodiazepines dispensing procedures in compliance with the Lebanese regulations.

**Methods:** A 14-item data collection sheet was designed to assess patient benzodiazepines history, drug indication, duration of therapy, prescribers specialty, prescription information, drug storing and dispensing procedures, patients adverse drug reaction reporting, patient medical history and other medication intake. The subjects participation in the survey was on voluntary basis

**Results:** Data from 106 outpatients, 64 (60 %) women with a mean age of 58 years, were analyzed in September 2011. Bromazepam was the most frequently used benzodiazepines (52%), followed by alprazolam (23%), and lorazepam (6.6%). It is noted that anxiety was the main indication for benzodiazepines use followed by sleep disorders with 70% and 26% consecutively. Furthermore, the duration of therapy varied between 3 to 12 months. Surprisingly, benzodiazepine was dispensed for 27 (25%) patients without a prescription on file. Out of 79 patients who have prescriptions on file, only 30% and 14% were prescribed by neurologists and psychiatrists consecutively while 56% were prescribed by various internal medicine specialties, gynecologists, and ophthalmologists. Information for all patients with a prescription was transcribed into the log book. Moreover, patients information (address and contacts) was not documents on 28% of the prescriptions. Benzodiazepines were dispensed by pharmacists for 76 patients (72%), while pharmacy staff dispensed 28% of the cases. It is to note that drugs were always stored in a key lock place that was kept closed in-between dispensing drugs.

**Conclusion:** These findings revealed an unjustified prescribing and dispensing of benzodiazepines, with an overuse in population below 65 years. Information gathered will be used to address strategies that should be adopted to improve overall health outcomes.

**3-081**

**Category:** Drug-Use Evaluation

**Title:** Evaluation of hypoglycemia after implementation of a revised insulin protocol

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**Purpose:** There are several causes of hyperglycemia in hospitalized patients that not only includes diabetes but also stress hyperglycemia due to critical illness, medications or parental nutrition. Hyperglycemia in these hospitalized patients may lead to complications such as an increased risk of infection, increased length of hospital stay, and increased morbidity/mortality. In 2010, the American Diabetes Association (ADA) recommended a goal blood sugar of 140-180 mg/dL based on the results of the NICE sugar trial, which highlighted the dangers of hypoglycemia with insulin infusion protocols. Our standard VCUHS insulin infusion protocol was revised and implemented June 14th, 2011 in order to incorporate the new blood glucose goals recommended by the ADA.

**Methods:** This study included all patients, 18 years and older, admitted between July 1, 2011 and October 31, 2011, with an active order for insulin infusions greater than one hour. The primary outcome of this institutional review board approved project was to determine the incidence of hypoglycemia, defined as a blood glucose less than 70 mg/dL, with the new protocol. Secondary outcomes included incidence of severe hypoglycemia (blood glucose less than 40 mg/dL), time to goal blood glucose, percent of patients in goal for greater than 50 percent of blood glucose readings, and appropriate treatment of hypoglycemia based on the insulin infusion protocol. Data was gathered from a retrospective chart review and descriptive statistics were utilized to interpret study results.

**Results:** There were 282 patients enrolled in the study (average age 56 plus/minus 15 years, 61 percent male). Most of these patients (84.4 percent), were in an Intensive Care Unit during the insulin infusion, with the majority of infusions being used in the Cardiac Surgery Intensive Care Unit (45.8 percent). Of the 295 hospital encounters, 31 percent of patients experienced at least one episode of hypoglycemia, with only 10 percent of these episodes being severe hypoglycemia, however only 30 percent of these hypoglycemic events were treated appropriately with dextrose according to the protocol. The mean time to goal blood sugar was 5.3 plus/minus 6 hours and over half of the patients enrolled (56 percent) were in blood glucose range for greater than or equal to 50 percent of the total time of infusion.

**Conclusion:** The revised protocol was successful as the majority of patients did not experience an episode of hypoglycemia, with only a small minority of these hypoglycemic episodes being considered severe. One issue that was identified was that most hypoglycemic events did not have

proper documentation of appropriate treatment and future implications include education regarding adherence to the treatment of hypoglycemia based on the protocol.

**3-082**

**Category:** Drug-Use Evaluation

**Title:** Evaluation of appropriate use of micafungin at a community hospital

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**Purpose:** To evaluate overall appropriate use of newly initiated micafungin therapy in an in-patient setting

**Methods:** This was a retrospective, observational medication use evaluation (MUE) of micafungin use in a 200 bed community hospital. The MUE included 26 patients that were selected from the pharmacy system database from January to May 2012 and had received newly initiated micafungin. Patients were evaluated using IDSA guidelines which included: cultures drawn prior to initiation of therapy, site of culture, cultured organism, history of azole antifungal use, neutropenia, daily cultures drawn after initiation of therapy in the case of candidemia, and appropriate length of treatment (LOT) from the first negative culture.

**Results:** Twenty six patients were evaluated. Four patients (15%) did not have cultures drawn prior to initiation of therapy and accounted for a total of 8 days of treatment. Twenty two patients (85%) had cultures drawn prior to the initiation of therapy. Fifty percent of cultured patients (n=11) received a total of 50 days of micafungin treatment, despite a negative culture. LOT ranged from <5 day (n=9) to 12 days (n=2). The remaining 11 patients had positive cultures for *Candida* species: 46% (n=5) positive urine cultures, 27% (n=3) positive blood cultures, 18% (n=2) positive sputum cultures, 9% (n=1) positive abdominal abscess cultures. *Candida non-albicans* accounted for 63% of cultured species, whereas, *Candida albicans* accounted for 37%. LOT for patient with candidemia and abdominal abscess were appropriate. Whereas patients with positive cultures from a non sterile site discontinued or changed therapy within 5 days and accounted for a total of 26 days of micafungin treatment.

**Conclusion:** Results of the MUE demonstrated suboptimal utilization of micafungin. Micafungin was utilized in patients with positive urine cultures and in place of first line agents such as azole antifungals. It was also utilized in >50% of patients despite repeated negative cultures. Limitations to this evaluation were a small sample number due to the hospital size and the review was retrospective. Education for the clinical staff is warranted to ensure optimal utilization of micafungin and to avoid resistance

**3-083**

**Category:** Drug-Use Evaluation

**Title:** Iron Sucrose Medication Use Evaluation

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**Purpose:** Iron sucrose is an intravenous iron formulation approved for the treatment of iron deficiency anemia in the following patient populations: chronic kidney disease not on dialysis (with or without erythropoietin therapy) and dialysis patients on erythropoietin therapy. The purpose of this study was to evaluate the use of iron sucrose for FDA-approved indications, dosing and monitoring parameters, potential cautions with use (active infection, normal or high iron levels, hemoglobin greater than 12 g/dL) and patient response.

**Methods:** The institutional review board approved this retrospective chart review of patients receiving at least one dose of iron sucrose between October 1, 2010 through December 31, 2010. Demographic data was collected as well as indication for iron sucrose, presence of active infection, contraindications to therapy, total cumulative dose and response.

**Results:** A total of 100 patients were evaluated in this study. The average age of patients was 62 years and 58 percent were female. Iron sucrose was used for FDA-approved indications 70 percent of the time, with the majority (63 percent) of iron sucrose used for hemodialysis patients also receiving erythropoietin. Most of the off label use was for the treatment of anemia due to acute bleeding and anemia of cancer/chemotherapy. Twenty one percent of patients received the recommended cumulative 1 gram dose. Twenty two percent of patients receiving iron sucrose also had a concomitant active infection, 20 percent of patients were not iron deficient or actually iron overloaded and 2 percent of patients were given iron sucrose with a hemoglobin concentration greater than 12 mg/dL. Finally, hemoglobin concentrations increased, on the average, by 11.5 percent.

**Conclusion:** Education and guidelines are necessary to improve iron sucrose prescribing, dosing and monitoring. An order set should be developed to ensure appropriate indication, dosing and monitoring of appropriate iron indices and hemoglobin concentration as well as potential cautions for use (infection and iron overload).

**3-085**

**Category:** Drug-Use Evaluation

**Title:** Evaluation of appropriate use of carbapenems at an acute-care community hospital

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**Purpose:** The carbapenem class of antibiotics has one of the broadest spectrums of activity of all the antibiotic classes. Recently, overuse of this class of antibiotics has led to the development of carbapenemase-producing bacteria. If a patient becomes infected with these types of bacteria, their likelihood of survival is reduced significantly. The purpose of this study was to determine the prescribing patterns for carbapenem use at our facility, and evaluate their appropriateness as described by evidence-based literature. This data would be used to determine if development of a restricted-use policy by an antimicrobial stewardship committee is warranted.

**Methods:** In this retrospective chart review, patients were selected from a computer-generated list of all patients charged for a dose of doripenem, imipenem, meropenem, or ertapenem in March of 2010. Data was sorted by date, starting from the most recent admissions and working backwards. Patients included in the study needed to be admitted as an inpatient, were 18 years of age or older, and had to have received a carbapenem for at least 24 hours. Patients were excluded from the study if they received a carbapenem from an outside facility for up to 4 days prior to admission at our facility. A total of 63 patients were included in the study. Appropriate indications for use included current or recent history of extended-spectrum beta-lactamase infection or other multi-drug resistant gram-negative pathogen-related infection, ventilator-associated pneumonia, severe sepsis, severe or life-threatening intra-abdominal infection, febrile neutropenia, or treatment failure on appropriate empiric antibiotics.

**Results:** Out of 63 patients, 29 patients (46%) were prescribed carbapenems appropriately. The most common indication for use was treatment failure on empiric antibiotics. In cases where use was not appropriate, common differential diagnoses included pneumonia (not ventilator-associated), non-severe sepsis (did not meet systemic inflammatory response syndrome criteria), and common intra-abdominal infections. Cultures were not obtained in 6 patients (9.5%). In cases where cultures were obtained, there were 29 instances (46% of all patients) where the therapy may have been narrowed based on culture results but was not. 35 patients (56%) were continued on carbapenem therapy until they were discharged from the facility.

**Conclusion:** The data indicates that carbapenems are often prescribed inappropriately at our facility. Based on the results of this evaluation, it appears that the patients here would benefit from a restricted-use policy for carbapenems overseen by an antimicrobial stewardship team.

**3-086**

**Category:** Drug-Use Evaluation

**Title:** Implementation of a clinical decision support system and its impact on alvimopan usage in a community hospital

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**Purpose:** To assess the impact of a clinical decision support system (CDSS) in guiding appropriate use of alvimopan in the community hospital setting.

**Methods:** Within a Cerner-based electronic medical record (EMR), a CDSS was designed and implemented at Banner Health to assist physicians in determining whether a patient is a candidate for alvimopan therapy. Providers ordering this medication within the computerized physician order entry (CPOE) system are presented with the CDSS. The CDSS provides guidance as they verify that the patient meets all of the predefined criteria before the order can be submitted. Banner-approved criteria are based on FDA-approved indications and limited to use in patients that: 1) are scheduled for laparoscopy or laparotomy for a partial large or small bowel resection; 2) have not taken therapeutic doses of opioids for more than 7 consecutive days immediately prior to alvimopan therapy; 3) do not have severe hepatic impairment; 4) do not have end stage renal disease; 5) are not undergoing surgery for correction of complete bowel obstruction. A retrospective medication utilization evaluation (MUE) for alvimopan was performed at Banner Estrella Medical Center (BEMC) to evaluate the impact of the CDSS. All patients who received alvimopan in 2011 were reviewed. Patient data was obtained from the EMR and included the five CDSS criteria, length of stay, whether the patient received the manufacture recommended pre-operative dose 30 minutes to 5 hours prior to surgery, and if the drug was discontinued after the patients first post surgery bowel movement or after a maximum of 15 total doses. If patients were not appropriately discontinued after their first bowel movement, the amount of additional doses was evaluated.

**Results:** A total of 26 patients were identified as receiving alvimopan therapy during the specified time frame, 24 of which were included in this review. The two patients who were excluded received only the pre-operative dose. A total of 23 (95.8%) of the 24 patients met all 5 of the specified CDSS criteria. The lone patient (4.1%) who did not meet criteria received therapy despite taking chronic opioid therapy at home. The average length of stay was 4.3 days. Four (16.6%) patients did not receive the pre-operative dose, no patients exceeded the maximum of 15 total doses, and 19 (79%) patients were inappropriately administered doses after first bowel movement was noted. On average, these patients received 1.7 extra doses after the first bowel movement with a range between 1 and 4 doses.

**Conclusion:** Our results suggest that a proactive, CDSS system can be successfully implemented using a CPOE-based EMR in the community hospital setting. This technology has the potential to impact the prescribing habits of hospital practitioners and could potentially decrease hospital expenditures of high-cost medications.

**3-087**

**Category:** Drug-Use Evaluation

**Title:** Evaluation risk of fracture associated with long term proton pump inhibitors therapy in the elderly in veterans health service medical center, Seoul, South Korea

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**Purpose:** Proton pump inhibitors (PPIs) are very effective medication, the most widely prescribed drugs, used to treat gastroesophageal reflux disease (GERD) and dyspepsia. They are also preferred to prescribe with nonsteroidal anti inflammatory drugs (NSAIDs) for patients who are at high risk of gastrointestinal bleeding. However, recent reports show that long term use of proton pump inhibitors increase the risk of complications such as fracture, hypomagnesemia and clostridium difficile associated diarrhea (CDAD). Specially, Some studies identify that the risk of fracture have been increased in patients over 50. Our study investigated the link between period of taking proton pump inhibitors (PPIs) and the risk of fracture.

**Methods:** We screened patients taking proton pump inhibitors (Omeprazole, Lansoprazole, Rabeprazole, Ilaprazole, Revaprazan) more than 1 year recently and over 50, using electronic medical record (EMR) system in veterans health service medical center from April 1, 2008 to May 31, 2012, retrospectively. We evaluated total administration period, age, clinical departments and the number of patients diagnosed fracture. We divided this group into four by its prescription period, 1 year to 2 years, 2 to 3 years, 3 to 4 years and 4 years or more.

**Results:** The total number of patients over 50 prescribed proton pump inhibitors (PPIs) for more than 1 year during the researched period was 1288. The average age of four group was 71. The clinical departments were gastroenterology, neurology, and so on. The rate of fracture was 3.4 percent in these patients. Among these patients, the number of patients using proton pump inhibitors (PPIs) from 1 to 2 years was 467, from 2 to 3 years was 420, from 3 to 4 years was 285 and 4 years or more was 116 persons. After investigating the rate of fracture according to the diagnosis code (international classification of diseases code) including fracture, the rate of fracture was 2.4 percent in 1 to 2 years group, 2.4 percent in 2 to 3 years group, 4.2 percent in 3 to 4 years group, 10.3 percent in 4 years or more group. This result shows that the rate of fracture was increased in long term PPIs therapy.

**Conclusion:** Overall, it appears that using proton pump inhibitors (PPIs) tends to increase the risk of fracture. The greatest increased risk for these fractures was seen in those who use for 4 years or long. In fact, the occurrence of fracture could be varied by age, sex, and some other

relevant factors. However, There was little difference in the average age of each group in this study. In order to minimize the risk of fracture, we should notice to healthcare professionals period of proton pump inhibitors administration. Furthermore, it will be required to improve an electronic medical record (EMR) system which can make healthcare professionals to enable appropriate prescriptions for the patients who require the long term use of PPIs. Pharmacists also should be able to monitor and more effectively counsel patients who require the long term use of PPIs.

**3-088**

**Category:** Drug-Use Evaluation

**Title:** Discharge management of acute coronary syndromes (DMACS) toolkit the Australian experience

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**Purpose:** The national quality improvement project Discharge Management of Acute Coronary Syndromes (DMACS) project in 2009 addressed evidence-practice gaps existing in Australia around the discharge management of patients with acute coronary syndromes (ACS). Following the completion of the project, hospitals indicated their desire to continue to improve their practice. The DMACS drug use evaluation (DUE) toolkit was developed to facilitate hospitals to continue quality improvement activities. The DMACS DUE toolkit is a quality improvement tool to assist hospital medical, surgical, pharmacy and nursing staff working with patients discharged with a diagnosis of ACS to conduct an audit of the discharge management of patients with ACS, using an electronic audit tool with an automated summary report, a link to resources for educational intervention and instructions for use. We aim to describe how the DMACS DUE toolkit assists hospitals to achieve ongoing quality improvement.

**Methods:** Two snapshot audits were undertaken in July and October 2011. Hospitals recruited a minimum of ten patients each and could select to audit an area of patient management; either discharge management and/or medicines on discharge. A summary of both aggregated and de-identified individual hospital results were provided on the selected key indicators (within the above areas) including discharge medicines counselling, documentation of an ACS management plan, communication of the ACS management plan and discharge prescription of guideline-recommended medicines to facilitate comparison amongst hospitals. Completion of an online feedback survey regarding the usefulness and useability of the toolkit was used as a measure of the uptake of the toolkit as a result of the snapshot audits.

**Results:** The DMACS toolkit has been downloaded by 93 organisations, 46 participated in the snapshot audits. Improvements in performance have been sustained for discharge medicines counselling (75% vs 71%), documentation of an ACS management plan (87% vs 89%) and communication to patients and general practitioners (80%). Prescription of guideline-recommended medicines at discharge was also sustained (69% vs 74%). 36 feedback surveys were received. 83% indicated there was team involvement undertaking this activity; ranging from two to six people involved, with 56% engaging cardiology. All respondents indicated that the audit tool overall was useful or extremely useful.

**Conclusion:** The stand-alone DMACS drug use evaluation toolkit has been utilised by a number of organisations throughout Australia. It has facilitated continued quality improvement activities to measure performance improvements for patients with ACS.

**3-089**

**Category:** Drug-Use Evaluation

**Title:** Is there any role for the clinical pharmacist in Lebanon?

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**Purpose:** In Lebanon there is a lack of knowledge of the importance of the clinical pharmacist role in the hospitals, which contributes to the shortage of skilled personnel in this field. The increasing incidence of medication errors in different medical wards can be reduced through encouraging the role of the clinical pharmacist. The objective of this study is to show the impact of the clinical pharmacist in the Lebanese hospitals and to evaluate the differences she/he can accomplish.

**Methods:** We conducted a prospective multicenter descriptive report in three Lebanese university hospitals during five months duration. We were interacting with the physicians and nurses for a period of one month on each floor through joining the daily rounds on patients. During this period, we screened inpatients' medical records. 297 interventions were collected from different hospital departments including cardiac care unit, intensive care unit, pediatrics, internal medicine, oncology and infectious departments. The primary outcome is to determine the types of medications and hospital units that the clinical pharmacist can intervene in mostly. The secondary outcome is to evaluate the extent of the health-care members' cooperation with the clinical pharmacist by determining the percentages of the approved interventions.

**Results:** 297 interventions were done. The highest percentages of interventions were on non-adherence to guidelines (28.3%), dose adjustment (21.5%) and in the cardiac care unit (28%). Antibiotics had the highest percentage of interventions (24.9%) followed by proton pump inhibitors (10.8%), antithrombotics (9.4%), and fluids and electrolytes (8.1%). The lowest interventions were on fibrates (0.3%). Out of 297, 122 interventions were approved (41.1%). The highest percentages of approved interventions were on non-adherence to guidelines (32.8%) and in the cardiac care unit (33%). According to the medication classes, most approved interventions were on the antibiotic class (38.5%) followed by antithrombotics (14.8%) and fluids and electrolytes (4.1%). Interventions done on amiodarone were 3.7%, 8.2% were approved.

**Conclusion:** The outcomes for this study assure that the introduction of a clinical pharmacist within the health-care professional team optimizes the drug use in different hospital units. Unfortunately, the cooperation of the medical team was not as expected since only 41.1% of detected errors were approved. This maybe explained that the role of the clinical pharmacist is still new and not adopted by a Lebanese law.

**3-090**

**Category:** Drug-Use Evaluation

**Title:** Pegfilgrastim use evaluation in a tertiary care hospital in the United Arab Emirates (UAE)

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**Purpose:** Pegfilgrastim is a long acting colony stimulating factor that is indicated to decrease the incidence of infections in patients with non-myeloid malignancies receiving myelosuppressive chemotherapy that is associated with high incidence of febrile neutropenia. It is an expensive medication that is widely used for all oncology patients at Tawam Hospital. The objective of the study was to evaluate the use of pegfilgrastim in the outpatient setting in accordance with the National Cancer Center Network (NCCN) guidelines. As per the NCCN Guidelines, primary prophylaxis with pegfilgrastim is recommended for the prevention of febrile neutropenia in patients taking chemotherapy regimens where the risk of febrile neutropenia (FN) is more than 20 percent. With chemotherapy regimens where the FN risk is between 10 to 20 percent, the decision to use colony-stimulating factors (CSF) is based on patient specific and treatment related risk factors. It is not recommended to give CSF with regimens where FN risk is less than 10 percent. Secondary prophylaxis is recommended for patients who experienced neutropenic complication from the previous cycle. In addition, pegfilgrastim should not be used in regimens given under 2 weeks duration.

**Methods:** A retrospective observational chart review for oncology patients receiving pegfilgrastim in the outpatient setting was done over 3 month period from April to June 2011. This study was approved by the Research Ethics Committee. Patient demographics, chemotherapy protocols as well as the indication and the pattern of use of pegfilgrastim were documented. A literature review was done on the potential risk of febrile neutropenia for the chemotherapy protocols used in these patients.

**Results:** The medical charts of 76 oncology patients were reviewed. Twenty-nine percent of patients were breast cancer patients followed by 12 percent with non-hodgkin lymphoma. Others were distributed between different non-myeloid malignancies. Three patients received pegfilgrastim for unapproved (off-labeled) indications; aplastic anemia and congenital neutropenia. In around 57 percent of patients, pegfilgrastim was used as primary prophylaxis and as secondary prophylaxis in the rest of patients. In most cases, the febrile neutropenia risk of the chemotherapeutic regimen used was found to be moderate (between 10 and 20 percent). In 11 patients (18 percent) pegfilgrastim was used with chemotherapeutic regimens with a low risk of febrile neutropenia (less than 10 percent). Out of these patients, 6 were given pegfilgrastim as primary prophylaxis. In 6 cases pegfilgrastim was given to patients where the chemotherapeutic

regimen is under 2 weeks in duration. All the patients received the recommended dose; 6mg subcutaneously 24 hours post chemotherapy.

**Conclusion:** In most cases pegfilgrastim use was in line with the NCCN guidelines. Given the substantial cost of pegfilgrastim, it is important to reinforce the appropriate use of pegfilgrastim as per guidelines. Among patients at low risk of neutropenic complications (FN risk less than 10%), pegfilgrastim should be used only as a secondary prophylaxis and it should not be given in chemotherapeutic regimens under 2 week duration.

**3-091**

**Category:** Drug-Use Evaluation

**Title:** Retrospective review of rituximab use in an oncology center in UAE

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**Purpose:** Rituximab is an anti-CD20 monoclonal antibody, widely used in Tawam Hospital in the oncology/hematology, rheumatology and nephrology settings. It is indicated for the treatment of CD20-positive B-cell non-hodgkin's lymphoma (NHL), CD20-positive chronic lymphocytic leukemia (CLL), wegeners granulomatosis (WG) and microscopic polyangitis (MPA). It has also received approval for the treatment of moderate to severe rheumatoid arthritis (RA), in combination with methotrexate, in adults with inadequate response to one or more tumor necrosis factor (TNF) antagonists. It is being used for several off-label indications, including burkitt's lymphoma, hodgkin's lymphoma, chronic immune thrombocytopenic purpura (ITP) and lupus nephritis. There are no previous retrospective studies that reviewed the overall institutional use of rituximab. The main rationale behind conducting this study is the increase in reported infusion related reactions in the past months and the need for standardization of its prescribing and administration as well as the restriction of its use. We established guidelines for rituximab use to serve as reference in the evaluation process. The aim of the study is to evaluate the use of rituximab at Tawam Hospital in the different settings in accordance with established guidelines.

**Methods:** It is a retrospective observational evaluation, approved by the Research Ethics committee, conducted over a two months period from January to February 2011. It included an electronic chart review for all adult and pediatric patients at Tawam Hospital who received rituximab during the study period. Data collection included demographic patient information, prescribing services, indication for use, adverse drug reactions, compliance with administration and premedication guidelines and monitoring parameters.

**Results:** Over a 2 months period, 53 patients were evaluated. The main users of rituximab were found to be adult hematology/oncology, followed by nephrology, pediatric oncology and to a lesser extent rheumatology. It is mainly used for NHL (64 percent) followed by CLL (13.2 percent). Dosing deviations of more than 10 percent from what is recommended were observed in 15 percent of the reviewed cases. It was also observed that premedication in the oncology setting was not according to the established guidelines. This may have accounted for the relatively low incidence of infusion related reactions occurring in our patients (7 percent) compared to what is documented in the literature (32-77 percent). Pneumocystis carinii pneumonia (PCP) prophylaxis was given to all CLL patients on fludarabine, similarly all CLL

patients received antiherpetic prophylaxis as required. The rate of administration followed was not fully in line with recommendations. Screening for hepatitis B is recommended prior to initiation of therapy, mostly in NHL cases and high risk patients; initial screening for hepatitis B was not retrieved in 36% of the reviewed cases.

**Conclusion:** It is important to implement guidelines for rituximab use to ensure proper patient screening, proper premedication administered and adequate patient monitoring.

3-092

**Category:** Drug-Use Evaluation

**Title:** Effects of colistin therapy on renal function in critically ill lebanese patients

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**Purpose:** Colistin a polypeptide cationic antibiotic which is bactericidal to gram-negative bacteria. Its implicated as a salvage therapy for the treatment of multi-drug resistant bacteria mainly *Acinetobacter Baumannii* and *Pseudomonas Aeruginosa* in critically ill patients. The therapeutic use of colistin is limited regarding the associated nephrotoxicity and neurotoxicity. The purpose of this study was to assess the effects of intravenous colistin on renal function in adult healthy patients.

**Methods:** A retrospective chart review was conducted to evaluate the impact of colistin therapy on renal function from two lebanese hospitals. The data collected included patient age, gender, weight, serial creatinine measurement, concomitant diseases and drugs. The specific information collected for colistin included the dosage prescribed and total length of treatment. Patients above eighteen years in the intensive care unit who were on colistin between January 2011 and April 2012 were included. Patients were excluded if they were taking nephrotoxic drugs, dehydrated, and previous renal dysfunction. The study was approved by the Institutional Review Board (IRB) and Committee for Human Research (CHR). Patient identifiers included only patient ID number and date of birth. These patient identifiers were used only to identify eligible patients and removed from all study data as soon as data collection was completed to assure that patient privacy was maintained. The primary outcome measure was a change from baseline in serum creatinine after colistin treatment. Descriptive statistics were used to report the results. The paired t-test was used to evaluate the primary outcome of mean difference between creatinine pretreatment and post treatment.

**Results:** There were 39 patients who met the inclusion criteria. The mean age (+/- standard deviation) was 64.25 +/- 19.82 years. The mean body weight was 78.87 +/- 22.83 Kg. The mean dose of colistin used was 5 million international units per day and the length of treatment was 12.5 days. The mean serum creatinine concentration pretreatment with colistin was 1.23 +/- 0.90 mg/dL and serum creatinine post colistin treatment was 1.37 +/- 1.91 mg/dl (95 percent confidence interval, p value equals 0.492).

**Conclusion:** No serious nephrotoxicity was observed in this group of patients who received intravenous colistin as reflected by insignificant change in creatinine values between baseline and post treatment. Colistin should be considered as a safe therapeutic option in patients with nosocomial infections due to multidrug resistant Gram-negative bacteria.

**3-093**

**Category:** Drug-Use Evaluation

**Title:** Evaluation of the appropriate use of imipenem/cilastatin in a tertiary care hospital: indication, dose, dose adjustment in renal impairment, and seizure risk

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**Purpose:** Imipenem/cilastatin has a very broad spectrum of activity against gram-positive, gram-negative, and anaerobic bacterial micro-organisms. The objective of this study is to evaluate the appropriate use of imipenem/cilastatin in a tertiary care hospital. The study will assess the indication (empirically and after the culture results are out), dose, dose adjustment in renal impairment, and incidence of seizure in hospitalized patients receiving imipenem/cilastatin.

**Methods:** We conducted a prospective observational study of 100 patients receiving imipenem/cilastatin at Rafic Hariri University Hospital over a 2-month period. A data collection form including all pertinent information (demographics, history of present illness, site(s) of infection, imipenem/cilastatin dose, bacterial culture(s) and sensitivity results, and efficacy and safety monitoring parameters). Patients were followed up from the initiation of the first dose of imipenem/cilastatin until discharge and/or discontinuation of the antibiotic. Evaluation of the appropriate use of imipenem/cilastatin was based on IDSA guidelines and drug package insert.

**Results:** The most common indications were urinary tract infections (27%) followed by sepsis (22%). The use of imipenem/cilastatin per indication was appropriate in 86% (N= 86/100) of patients. 51% of the patients had a creatinine clearance of less than 70 ml/minute. The dose of imipenem/cilastatin was appropriate in only 41% of patients with renal impairment, and in 94% of patients with normal kidney function. Only one patient developed seizure while on imipenem/cilastatin and was switched to a different antibiotic.

**Conclusion:** This evaluation of the use of imipenem/cilastatin shows that our hospital needs interventions that can lead to improved patient care, especially in the appropriate dosing of the antibiotic in patients with renal impairment. The presence of a clinical pharmacist as part of an infectious disease interdisciplinary team could improve the appropriate use of antibiotics.

**3-094**

**Category:** Drug-Use Evaluation

**Title:** A retrospective analysis on potential drug use in hyperbilirubinemia

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**Purpose:** Hyperbilirubinemia (HBM) is a disease states that is sometimes induced by medications, and it can cause jaundice, mental status changes, and alterations in pharmacokinetics. The purpose of the study is to distinguish and evaluate medications that can induce HBM based on total bilirubin (TB) levels, so that we can provide optimal drug therapy to patients.

**Methods:** We measured the risk of drug-induced HBM based on Seoul National University Hospital (SNUH) Electronic Medical Recode (EMR). The inclusion criteria of the study were all the patients whose TB levels were measured more than 4 times, and who were taking top 30 SNUH HBM Annual Occurrence Index (AOI) medications or high risk medications known to induce HBM. We separated the patient based on their baseline TB level of 1.8 mg/dl, and then we used 3 factors to calculate the bili-constant in 3-dimensional space to assess occurrence of HBM in each group. The 3 factors consist of max TB/1.4 mg/dl, time to reach TB greater than 1.8 mg/dl, and  $[\text{max TB} - \text{baseline TB}] / [\text{time to reach max TB}]$ . The measurement of bili-constant  $(\text{mg/mL/d})^2$  is defined as changes of TB value in a day. The large number of bili-constant shows that there is significant increase in TB in 1 day, and this indicates that the risk for HBM occurrence is high.

**Results:** We were able to stratify the high-risk medications that induced HBM based on bili-constant value. There was significantly high bili-constant in a group with baseline TB greater than 1.8 mg/dl when compared to previously known hepato-toxic medications. Compared to patients with TB less than 1.8 mg/dl, the individuals with TB greater than 1.8 mg/dl had higher risk for HBM induced by the medications. Additionally, the bili-constant of the low-risk medications known to minimally cause HBM was lower than the high-risk medications.

**Conclusion:** The result is consistent with previously known facts that when TB is greater than 1.8 mg/dl, we can use bili-constant to evaluate high-risk medications that induces HBM. This study is significant because it quantifies previously HBM-inducible high-risk medications. Therefore based upon this study, we anticipate providing the most optimal drug therapy to patients by assessing underlying disease states and concurrent medications of the patients, and being aware of HBM-inducible high-risk medications.

**3-095**

**Category:** Drug-Use Evaluation

**Title:** Adherence to Medication Treatment Regimens among Schizophrenia Patients Treated with Paliperidone Palmitate in Community Mental Health Centers

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**Purpose:** Paliperidone Palmitate (PP) is an atypical long-acting injectable antipsychotic therapy (LAT) indicated for the treatment of schizophrenia in adults. To date, there is limited data exploring real-world treatment regimen adherence patterns for patients treated with LATs as measured by the mean gap in days between injections. Clinical repercussions of not receiving medication at indicated intervals can be influenced by medication half-life, with LATs such as PP offering wider coverage (mean half-life 24-49 days, depending on the dose) (Owen, 2010) than oral therapies (range: 375 hours) (Nasky, 2008), which may impact medication effectiveness. The literature has reported maximum medication gaps for patients treated with oral atypical antipsychotics as ranging in days from 1-10 (40%), 11-30 (27%), and 30+ (26%) across a cohort of Medicaid patients with schizophrenia (Weiden, 2004). The purpose of this analysis is to present real world data on medication gaps and additional treatment pattern measures for CMHC patients with schizophrenia who were initiated on PP.

**Methods:** Utilization data were obtained from the Managed Health Care Associates network of independent long-term care pharmacies from 9/1/2009 to 8/31/2011. All patients captured in this database received treatment in a CMHC and were required to have  $\geq 1$  claim for a PP injection and a diagnosis of schizophrenia (295.x) within a 12 month period prior to treatment initiation. If a patient had  $\geq 1$  claim, the first claim for PP appearing during the specified analytical timeframe was used in this analysis (the first claim in the dataset may not represent the index paliperidone palmitate injection as it may have occurred in a hospital environment). Outcomes included: the number of days between injections (medication gaps), the percentage of patients persistent with PP over a 12 month period (continuous injections allotting for a pre-defined grace period between injections), the percentage of patients partially persistent with PP over a 12 month period (persistent with therapy, although with one or more injections falling outside the allotted grace period), the average # of injections per patient, and the average days with medication coverage.

**Results:** 348 patients met the inclusion criteria among which 62% were male and 38% were female; 34% were between 18-34 years of age and 25% were aged 35-44. Medication gaps ranged from 0.6 days (between injections 11 & 12) to 5.4 days (between injections 5 & 6), indicating adequate medication coverage from a pharmacokinetic perspective. The weighted

average medication gap over the entire 12 month followup period was 2.9 days. The percentage of patients who were either persistent or partially persistent with initial PP therapy over the 12 month follow up period was 65.8%. Among the 310 patients who had two or more injections, 74% were persistent or partially persistent at 12 months. Approximately 44% of the 348 patients in the cohort had 12 or more injections and 65% of patients had between 271-360 days covered by medication, respectively. Among patients who were persistent at month 6, the average days on therapy per patient were 336/360, respectively.

**Conclusion:** These data provide insight into PP medication treatment regimen adherence as indicated by medication gaps for CMHC patients with schizophrenia. These data indicate that adherence to PP medication regimen is good with minimal medication gaps. Additionally, the majority of PP-initiated patients were persistent with treatment at 12 months. Further analyses are warranted to determine the differential impact of medication coverage and persistence with oral antipsychotic and long-acting therapies on outcomes.

**3-096**

**Category:** Drug-Use Evaluation

**Title:** Impact of a daptomycin prescribing restriction at a community hospital: six months before and after intervention

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**Purpose:** To compare the use of daptomycin at our facility six months before and after a Pharmacy and Therapeutics (P&T) committee approved restriction which limited prescribing authority to infectious disease physicians for appropriate use in patients infected with susceptible microbes.

**Methods:** Two separate retrospective chart reviews were performed from January 2011 thru June 2011 and from November 2011 thru May 2012. Between these two intervals (November 1st 2011) the P&T committee approved a prescribing restriction based on the initial review of daptomycin to infectious disease physicians. The restriction also indicated that the drug may only be used for appropriate use in the treatment of susceptible microbes. Our primary endpoint was to determine if the prescribing restriction improved the appropriate use of daptomycin. Appropriate use was defined as: failed first line treatment for susceptible gram positive organisms (*S. aureus*, *S. pyogenes*, *S. agalactiae*, and *S. dysgalactiae* subsp *equisimilis*), failed vancomycin therapy for vancomycin-susceptible strains of *E. faecalis* or an allergy/sensitivity that prevented the use of first line agents. Converting the patient to daptomycin for the purpose of in-office infusion was deemed to be an inappropriate use by the P&T committee and for this study. Our secondary outcomes were as follows; microbe identification and susceptibility, outcomes, reason for initiation of daptomycin, concomitant antibiotics, comparison of dose versus indication, adjustment in renal function, treatment duration, if creatinine kinase (CK) was monitored, and average cost of preceding antibiotic regimen versus the inappropriate daptomycin regimen.

**Results:** Daptomycin was prescribed to a total of 23 patients (11 males and 12 females) over the study period totaling 12 months (9 patients pre-intervention and 14 patients post-intervention). The average age was 54 years (range of 34 to 76), average weight 87.81kg (range of 50kg to 128.2kg), average height 66.68 inches (range 62 to 71.3 inches), the average number of doses received was 4 (range of 1 to 9 doses), average dose was 441mg (range of 225 to 900mg) and average treatment length was 3.6 days (range 1 to 9). Pre-intervention appropriate use was determined to be three of nine (33%), with the remaining six (67%) being inappropriate. Post-intervention appropriate use was five of fourteen (36%), the remaining nine (64%) were determined to be inappropriate. The indications for use as well as number of patients included; 17 complicated skin or skin structure infections (cSSSI), 2 bacteremia, 2 osteomyelitis, 1 pneumonia, 2 urinary tract infections and 1 septic joint infection. Reasons for initiation of

daptomycin were 7 for in office infusion, 7 empiric, 5 failures to respond to previous antibiotics, 3 side effects from first line therapy and 1 patient was continued on daptomycin on admission. Concomitant antibiotics used were 3 meropenem, 2 clindamycin, 4 piperacillin/tazobactam, 1 cefepime, 1 ertapenem, 1 rifampin (oral), 1 azetronam, 2 levofloxacin and 1 1 fluconazole. Of the 17 patients receiving the antibiotic for a cSSSI, 7 received the recommended dosing of 4mg/kg and 10 received 6mg/kg (2 of these patients also had bacteremia and 1 had a UTI in addition to the 2 infections). Other dosing included; bacteremia 6mg/kg, osteomyelitis 6mg/kg, and the patient receiving daptomycin for a septic joint infection received 6mg/kg. Microbes identified were: methicillin-resistant *Staphylococcus aureus* (MRSA) 8, methicillin-susceptible *staphylococcus aureus* (MSSA) 4, *Acinetobacter baumannii* 2, *Propionibacterium acnes* 1, *Strep agalactiae* (Group B) 1, Unidentified staph species 1, *Strep pyogenes* (Group A) 1, *Klebsiella pneumonia* 1, *Pseudomonas aeruginosa* 3, *Staphylococcus epidermidis* 1, *Enterococcus faecalis* 3, *Enterococcus faecium* 1, *Providencia stuartii* 1, *Staphylococcus haemolyticus* 1, *Serratia fonticola* 1, *Pseudomonas stutzeri* 1, *Enterobacter cloacae* 1, *Enterococcus avium* 1, and *Escherichia coli* 1. Outcomes were as follows; 1 patient left against medical advice, 2 patients discharged to a long term care or skilled nursing facility on daptomycin, 4 patients de-escalated and discharged home on other antibiotics, 4 patients discharged home or to a long term care facility with no antibiotics, 2 patients were de-escalated to a different antibiotic during their hospital stay and 10 patients discharged home with plans for in office daptomycin infusion. Dose adjustment was indicated and adjusted in 2 patients based on a creatinine clearance of <30ml/min. Creatinine kinase (CK) monitoring occurred in a total of six patients, three pre-intervention and three post-intervention. Only one CK was drawn prior to initiation of treatment and the remaining was drawn during or after treatment, there were no abnormal CK levels observed during this study. Simvastatin use along with daptomycin occurred in three patients, all of which were in the post-intervention phase and did not have a CK level drawn. On average the inappropriate daptomycin regimen cost \$770.15 more than the preceding antibiotic regimen.

**Conclusion:** Based on the results obtained we have concluded that there was a minor (1%) difference in the inappropriate use of daptomycin at our facility post intervention. Seventy nine percent of the use at our facility was for an FDA approved indication, while 17% was for an acceptable off label use. There was one incidence where a patient received daptomycin for pneumonia, this was pre-intervention. Our facility will be initiating an antibiotic stewardship program (ABS) in August 2012, this should improve the appropriate use of daptomycin, appropriate dosing for indication, as well as the monitoring of CK. In addition to the ABS our facility will be implementing a computerized physician order (CPOE) entry in July 2012. With this change we will be able to create a CPOE order set that combines correct dosing, an order for CK monitoring prior to the first dose and once weekly while on therapy, and an option to discontinue simvastatin if applicable. In order to evaluate our ongoing efforts to improve the use of daptomycin at our facility, a follow up medication use evaluation will be performed six months after the stewardship is started.

**3-097**

**Category:** Drug-Use Evaluation

**Title:** Economic implications of the misuse of proton pump inhibitors for stress ulcer prophylaxis in hospitalized patients

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**Purpose:** There have been estimates that 58-92% of hospitalized patients receiving proton pump inhibitors (PPIs) for stress ulcer prophylaxis (SUP) are receiving them inappropriately. Misuse of PPIs can result in many complications, such as hospital-acquired pneumonia (HAP) and Clostridium difficile infections (CDI), which increase cost burden to the hospital. This study was designed to examine the economic impact of misusing PPIs for SUP in hospitalized patients.

**Methods:** Clinical and economic literature were reviewed for incidence rates and costs of CDI and HAP associated with proton pump inhibitor use in hospitalized patients. Acquisition cost and usage data were obtained from a Boston teaching hospital. Usage data included: admissions per year, number of patients on PPIs, intravenous or oral PPI usage and costs, cost and incidence of CDI and HAP (associated with PPI), total costs to hospital, inappropriate PPI administration, and total preventable costs. Data extracted from the literature were extrapolated to estimate the number of patients on PPIs for SUP and the incidence of inappropriate use. Additionally, charges associated with treating CDI and HAP were obtained from the literature, which were then adjusted for inflation to 2011 dollars. Charge data was then corrected using a cost-to-charge ratio. Using the above information, a budget impact analysis was conducted to further evaluate the economic impact of misused PPIs from a hospital payer perspective. A sensitivity analysis was performed to examine how the economic impact of misused PPIs would differ if the values of certain variables changed.

**Results:** The potential cost savings for this 191-bed hospital from proper SUP administration is estimated to be \$1,157,106, annually. Variables explored with the sensitivity analyses included: the percentage of patients who were prescribed PPIs (5-10%); how many of those prescriptions were indicated for SUP (64-88%); the costs of treating CDI (\$3,893-\$6,002) and HAP (\$34,450-\$35,205); percentage of patients who were affected by CDI (2.15-3.15%) and HAP (2.3-4.3%) due to PPI administration; and the number of patients who were prescribed PPIs inappropriately (58-92%). Annual cost savings can potentially range from \$338,397 to \$2,844,477 based on these sensitivity analyses.

**Conclusion:** The inappropriate use of PPIs can result in notable excess costs. These results suggest that strict enforcement of ASHP Guidelines for SUP will promote optimal patient care and reduced costs to hospitals.

**3-098**

**Category:** Drug-Use Evaluation

**Title:** Medication use evaluation of ipratropium in chronic obstructive pulmonary disease

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**Purpose:** In December 2011, a chronic obstructive pulmonary disease (COPD) Global Strategy for the Diagnosis, Management, and Prevention of COPD (GOLD) Guideline update was published in which classification of COPD was changed to more accurately reflect the complexity of the disease. Spirometry is still needed for diagnosis but is no longer the basis of COPD staging and patient symptoms are now a central part of staging. The purpose of this project was to evaluate adherence to COPD GOLD Guidelines in a rural VA facility.

**Methods:** The facility's Pharmacy and Therapeutics Committee approved this retrospective medication use evaluation chart review of patients who received inhalers containing ipratropium from March 1, 2011 through February 28, 2012 from the facility. Patients with forced expiratory volume in one second over forced vital capacity (FEV1/FVC) less than 70 percent and those with FEV1 less than 80 percent were converted from ipratropium or albuterol/ipratropium to tiotropium plus albuterol inhaler as needed. Adherence of therapy to guidelines was assessed before and after conversion.

**Results:** Of the 361 patients reviewed, 37 percent were converted to tiotropium. The remaining 63 percent were not converted due to mild COPD (7 percent), no pulmonary function tests on file (25 percent), spirometry such that COPD diagnosis criteria not met (27 percent), and the remaining 4 percent were not converted for other reasons such as refill history, no longer a patient under our care, and physician preference. Prior to conversion, only 30 percent of the patients reviewed were on therapies that adhered to the GOLD guidelines. Adherence to the guidelines increased to 70 percent after conversion was completed. Forty-three percent of the patients with a COPD diagnosis were on two forms of scheduled beta-agonists.

**Conclusion:** COPD patient care could be improved to better adhere to the COPD GOLD Guidelines 2011 Update. Areas for improvement include adding inhaled glucocorticosteroids too early in therapy and not having an as needed short-acting beta agonist for all COPD patients. Our health care system also has many asthmatic patient on albuterol/ipratropium which does not have a role in long term treatment of asthma. Provider and respiratory therapy education has been completed. Patients are no longer able to receive a prescription for albuterol/ipratropium if FEV1/FVC is greater than 70 percent. Other strategies to improve prescribing habits are being developed.

**3-099**

**Category:** General Clinical Practice

**Title:** Case report: Asymptomatic bradycardia possibly associated with travoprost therapy

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**Purpose:** This case report reveals the asymptomatic bradycardia possibly associated with travoprost therapy. Travoprost (Travatan) is a prostaglandin ophthalmic solution. It is used as a second-line therapy for open-angle glaucoma according to the Clinical Practice Guideline of the American Optometric Association. However, travoprost has recently been used as a first-line therapy in many patients because of its effectiveness and a once daily dosing. An 87-year-old man experienced asymptomatic bradycardia while using travoprost ophthalmic solution. Significant bradycardia is defined as heart rate or pulse of less than 60 beats per minute. The patient's pulse ranged from 42 to 50 beats per minute while receiving travoprost therapy during his hospitalization. Based on the clinical judgement of the treating physician, the assistance of the pharmacist, and a consultation with the ophthalmologist, travoprost was discontinued. This is because travoprost was thought to be the likely cause of significant sinus bradycardia in this patient. His average pulse was 66 beats per minute after travoprost discontinuation. Based on Naranjos Scoring System which was used as an objective tool, for assessing the likelihood of drug-induced adverse effects, a score of 3 was obtained which indicated a possible adverse effect. To our knowledge, this is the first case report about significant bradycardia possibly associated with travoprost therapy. Further research or studies are required to confirm the bradycardic adverse effect of travoprost. However, clinicians should be aware of the possibility of significant bradycardia associated with the use of this ophthalmic solution. Based on clinical knowledge and experience, pharmacists can expedite the process of identifying which drug is the most likely cause for a potentially serious adverse effect. This would ultimately help to improve patient safety and outcomes.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

### 3-100

**Category:** General Clinical Practice

**Title:** Use of calculated FRAX score to assess clinical readiness for discontinuation of alendronate therapy in a male veteran population

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**Purpose:** The fracture risk assessment (FRAX) tool is recommended for use in determining whether initiation of bisphosphonate therapy is indicated. Once started, patients may remain on therapy for years without re-evaluation for continued need. Long-term studies suggest that clinical benefit may continue despite discontinuation of therapy as bisphosphonates accumulate in bone matrix and continue to be released, resulting in half lives on the order of years. The well-established risk of esophageal irritation and the emerging evidence of long-term side effects of atypical fractures and osteonecrosis of the jaw have led to unclear recommendations for re-evaluation and discontinuation. The purpose of this study was to determine the potential rate of alendronate discontinuation after 5 years of therapy based on the risk of a hip fracture as calculated by the FRAX tool at a small Veterans Affairs Medical Center (VAMC) serving approximately 30,000 unique veterans yearly.

**Methods:** The VAMC institutional review board approved this retrospective, randomized chart review of patients with an active prescription for alendronate on January 1, 2005, issued through the VAMC. Male patients aged 50 to 89 years with osteoporosis and a 5-year history of alendronate therapy were included. Patients with active cancer or Pagets disease were excluded. Data on clinical risk factors for fractures and bone mineral density (BMD) were collected, in order to calculate the risk of a hip fracture using the FRAX tool. Regardless of whether patients discontinued alendronate when 5 years of therapy was completed or continued therapy for longer than 5 years, data was collected 5 years after initiation of alendronate. Patients met the proposed criteria for discontinuation when the risk of a hip fracture was less than 3% and BMD was either unavailable, normal, or in the osteopenic range. The primary outcome was the potential discontinuation rate of alendronate treatment based on calculated FRAX score. Secondary outcomes include the actual rate of discontinuation observed in practice, the duration of alendronate therapy, the rate of fractures, atypical fractures, and osteonecrosis of the jaw.

**Results:** Of the records reviewed, 40 met criteria for inclusion. Sixteen patients met the proposed criteria for discontinuation, compared to the 8 patients who discontinued therapy in practice. This resulted in a 40% potential and 20% actual discontinuation rate. There was a 45% agreement between the proposed FRAX criteria and practice, which was primarily due to agreement in continuation of therapy (94.4%). Only 1 of 8 patients in which therapy was

discontinued met the proposed FRAX criteria. On average, patients were on therapy for 7 years. Four of the patients reviewed experienced fractures and no patients experienced atypical fractures or osteonecrosis of the jaw.

**Conclusion:** The large difference in the rate of potential and actual alendronate discontinuation suggests that providers lack guidance in determining the appropriate course of action once 5 years of alendronate therapy has been completed. The FRAX tool may be used to provide this guidance. Larger, prospective, long-term studies are needed to validate this novel use of the FRAX tool.

### 3-101

**Category:** General Clinical Practice

**Title:** Evaluation of the rates of proton pump inhibitor use, documentation of proper indications, and possible proton pump inhibitor associated risks at a community hospital

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**Purpose:** To evaluate the rates of proton pump inhibitor (PPI) use (any agent), the presence of documented proper indications, and the rates of possible associated PPI risks as compared to data published in current literature evaluating risks associated with long-term use of PPIs.

**Methods:** The Institutional Review Board approved this study and no patient consent forms were required for data collection. A retrospective, observational study was conducted for all patients admitted for longer than 24 hours in January 2011. Data were collected for a total of 744 patients. Data included prior to admission PPI use and documented indication for use, admission diagnosis, use of PPI while hospitalized and documented indication, evidence of possible risks including pneumonia, C. difficile infections, and fractures, discharge PPI prescriptions and indications for use.

**Results:** Prior to admission, 21.9% (163/744) of patients were taking a PPI, however there was no documented PPI indication in the admission history in 44.8% (73/163) of the cases. Of the 163 patients on a PPI, 22.7% (37/163) were admitted with pneumonia, 0.01% (2/163) were admitted with C. difficile, and 3.1% (5/163) were admitted with a fracture. While hospitalized, 41.5% (309/744) of patients were prescribed a PPI. Indications for inpatient PPI use were further evaluated. Prophylaxis which included stress ulcer, on ventilator, or concurrent aspirin, NSAID, or anticoagulation use was documented in 60.5% (187/309) of PPI patients. A gastrointestinal bleed diagnosis or endoscopy order was documented in 12.6% (39/309) of patients. GERD was documented for 13.6% (42/309) of patients, peptic ulcer disease and Barretts esophagus were documented for 2.6% (8/309) of patients. No documentation for PPI use was found in 10.7% (33/309) of patients. Of the 309 inpatients on a PPI, new development of any complications was evaluated. Three percent (10/309) developed pneumonia, with eight patients being diagnosed with healthcare associated pneumonia. Also, 2.6% (8/309) of patients developed C. difficile identified by positive stool culture. As some patients overlap in both PPI groups (prior to admission and while hospitalized), statistical analysis could not be calculated.

**Conclusion:** Of patients on a PPI prior to admission, 22.7% were admitted with a diagnosis of pneumonia and 3.1% with a fracture, which are comparable to rates listed in recent literature on associated PPI risks. Also documentation of an indication was lacking in 44.8% of patients admission histories, therefore either admission histories were incomplete or patients did not

require a PPI. Forty one percent of inpatients were prescribed a PPI, with the majority (60.5%) having prophylaxis documented as the indication for use. This high rate of PPI use is concerning and may place patients at risk for complications or withdrawal symptoms.

**3-102**

**Category:** General Clinical Practice

**Title:** Implementation of a pharmacist managed insulin protocol: five years later

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**Purpose:** A pharmacist managed insulin protocol for glycemic control, including basal bolus insulin and insulin infusion, was implemented in January of 2007. Physicians selected patients and ordered either basal bolus insulin or insulin infusion pharmacy protocols via computerized order entry. The objective of this study was to compare the overall glycemic outcomes of hospitalized patients by evaluating all blood glucose levels from 2006 to 2011 for the percent of hyperglycemia, normoglycemia, hypoglycemia, and severe hypoglycemia results. Data from 2006 were included to provide a baseline prior to implementation of any pharmacy insulin protocols.

**Methods:** The Institutional Review Board approved this study and no patient consent forms were required for data collection. The Pharmacy and Therapeutics Committee approved the pharmacist managed insulin protocols. Both medical and surgical patients, type 1 and 2 diabetic patients, and any other patients requiring glycemic control were included. Data were retrieved from the hospital computer system, RALS program, and maintained confidentially. The target blood glucose range for all insulin protocols from 2007-mid 2009 was 90-130. Based on the emergence of new clinical trial results the target range was revised mid 2009 to the present to be 130-180. For patients on the basal bolus protocol, the pharmacist calculated the total daily dose based on the patient's weight, assessment of their home insulin regimen, A1C, current insulin requirements, and ordered scheduled insulin glargine, a short-acting insulin analog, and a short-acting insulin analog correction dose. If eating, accuchecks were monitored before meals, before bedtime, and at 0300. If on tube feeds or NPO, the short-acting insulin analog was scheduled every six hours as required and accuchecks were monitored every six hours. If patients were started on the insulin infusion protocol, using regular insulin, the pharmacist calculated the bolus and starting infusion rate based on the most recent accucheck. Accuchecks were monitored hourly and the infusion rate was titrated until blood glucose levels were stable within the target range.

**Results:** Pharmacy insulin protocols were counted and compared to the estimated total number of patients per year which was calculated taking the total number of accuchecks per year and divided by 5 to determine the average number of accuchecks per patient per day, then divided by 5 for average length of stay. Blood glucose readings, for an average of 6567 patients per year, were graphed annually from 2006 to 2011. Objectives measured included: the percent of hyperglycemia (BG > 180), normoglycemia (BG 90-180), hypoglycemia (BG 50-89), and severe

hypoglycemia (BG < 50) results. For this large sample, the percent of blood glucose measurements indicating severe hypoglycemia has been decreased from 1.03% in 2006 to 0.59% in 2011. The percent of blood glucose measurements indicating hypoglycemia decreased from 8.67% in 2006 to 6.02% in 2011. The rates of normoglycemia and hyperglycemia have remained constant, with less than a one percent change from 2006 to 2011. The number of pharmacy insulin protocol orders has steadily grown each year from 154 protocols in 2007 to 499 protocols in 2011, with the majority being basal bolus protocols.

**Conclusion:** The steady decrease in percent of severe hypoglycemia and hypoglycemia results, while having maintained a similar percent of normoglycemia and hyperglycemia results over the past five years, are due in large part to prescriber education about the pharmacy insulin protocol for glycemic control, increased use of the pharmacist managed insulin protocol, and increased awareness about basal bolus insulin dosing.

**3-103**

**Category:** General Clinical Practice

**Title:** Implementation and results of a pharmacist directed inpatient hyperglycemia management service

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**Purpose:** Over the past decade, glycemic control among hospitalized patients has generated considerable interest. The importance of well controlled blood glucose in the inpatient setting has recently been addressed by several national organizations. In 2008, our 250 bed community owned hospital had diminished access to endocrinology consultation for an increasing number of inpatients experiencing hyperglycemia. The pharmacy department was encouraged to create a service to complement the existing endocrinology practice. The goal was to develop and make available to the medical staff, a pharmacist directed hyperglycemia management service for inpatients not requiring an endocrinology consultation.

**Methods:** Inpatient pharmacy staff meetings were held to determine whether this service would be supported by staff pharmacists. After obtaining pharmacist staff support, an ad hoc committee was formed comprised of representatives from pharmacy, nursing, diabetes education and endocrinology. This committee identified and outlined the responsibilities of the stakeholders, developed a new hyperglycemia management protocol and outlined goals of the program. Responsibilities of the pharmacists included the initiation and adjustment of insulin therapy, both intravenous and subcutaneous administration, daily progress notes in the patient medical record, and 24 hour service coverage every day. An inpatient hyperglycemic management protocol was established. The hyperglycemia management protocol was approved by institutional medical staff committees in September, 2008. All staff pharmacists underwent subsequent training via two educational sessions. All pharmacists were required to pass a written competency prior to program initiation. Dosing tools and monitoring forms were created in the health information system. Quarterly reporting was established to report several parameters of dosing outcomes including the number of patients managed, percentage of blood glucose values greater than 180 mg/dL, percentage of blood glucose values less than 70 mg/dL, mean blood glucose value and the percentage of patients with an admission diagnosis of diabetes. The service was officially launched in December, 2008.

**Results:** In 2009, the first full year of service, pharmacists managed 4 percent of patients requiring insulin. In 2010, the service volume expanded to 15 percent of patients requiring insulin and in 2011 increased further to 36 percent of patients requiring insulin. The percentage of blood glucose values less than 70 mg/dL in patients managed by pharmacists was 2.5, 2.4, and 2 percent annually for 2009, 2010 and 2011 respectively. This compares to results of 2.2, 1.8, and 1.6 percent from providers, other than endocrinology, for the same period. The percentage of

patients with blood glucose values greater than 180 mg/dL in patients managed by pharmacists was 23.6, 28.3, and 30.5 percent annually for 2009, 2010 and 2011 respectively. This compares to results in patients managed by providers, other than endocrinology, of 28.9, 31.6, and 29.3 percent. The mean blood glucose achieved in patients managed by the pharmacist service was 151.9, 161.4, 163.4 mg/dL respectively for 2009, 2010 and 2011. This compares favorably to results in patients managed by providers, other than endocrinology, of 162, 166.5 and 163.2 mg/dL in the same comparative years. The cumulative percentage of patients from 2009 through 2011 with hyperglycemia and an admission diagnosis of diabetes who were managed by the pharmacist service was 84 percent, versus 92 percent of those patients managed by endocrinology and 73 percent managed by other providers. The scope of the service expanded in 2010 to include post-bariatric surgery patients. Additional education and dosing tools were provided to improve areas noted to be outside of established goals.

**Conclusion:** Pharmacist involvement in insulin management has resulted in similar levels of glucose control in comparison to patients managed by other providers, excluding those managed by endocrinology. Furthermore, excluding those patients managed by endocrinology, more patients with an admission diagnosis of diabetes were referred to the pharmacist directed consult service than managed by other providers.

**3-104**

**Category:** General Clinical Practice

**Title:** Disease Trajectory and Treatment Practice for Chronic Obstructive Pulmonary Disease (COPD): Results from a Nationally Representative Physician Survey

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**Purpose:** COPD is an increasing health concern in the United States. Adherence to COPD practice and treatment guidelines is essential to improve COPD treatment outcomes. The objective of this study was to characterize physician-reported COPD severity, exacerbation rates, and use of guidelines for treatment of their COPD patients.

**Methods:** A nationally representative sample of COPD-treating pulmonologists (PULMs) and primary care physicians (PCPs) reported on the severity of COPD patients they see in their practice and the proportion of patients who experienced moderate, or severe exacerbations in the last 6 months. Physicians also reported on what they consider to be elements of an exacerbation and their utilization of classification systems for determining COPD severity and treatment.

**Results:** 45 PULMs/54 PCPs reported that 40.6% $\pm$ 18.7%/ 13.4% $\pm$ 9.6% of their patients were diagnosed with COPD ( $p < .0001$ ). Among patients  $>40$  years old, PULMs (vs. PCPs) treated more severe (32% $\pm$ 11.4% vs. 21% $\pm$ 11.6%,  $p < .0001$ ) or very severe (17.9% $\pm$ 8.8% vs. 9.6% $\pm$ 6.5%,  $p < .0001$ ) COPD patients. For patients with mild/moderate/severe/very severe COPD, physicians estimated a mean 13.3%/26.7%/41.5%/60.0% of patients experienced a moderate exacerbation and 4.2%/11.7%/24.6%/37.2% of patients experienced a severe exacerbation in the past 6 months. The most frequently reported factors used to identify/define exacerbations were worsening of previous stable conditions (PULM/PCP: 93.3%/98.1%), increased dyspnea (91.1%/98.1%), and requiring use of systemic corticosteroids (86.7%/85.2%). Both PULMs (vs. PCPs) reported using Global Initiative for Chronic Obstructive Lung Disease (GOLD) or American Thoracic Society/European Respiratory Society (ATS/ERS) for classifying COPD severity (GOLD: 91.1% vs. 83.3%,  $p = 0.254$ ; ATS/ERS 28.9% vs. 18.5%,  $p = 0.254$ ), with PULMs being more likely to report using GOLD for COPD treatment (GOLD: 93.3% vs. 75.9%,  $p = 0.019$ ). However, 8.9% of PULMS/ 11.1% of PCPs indicated that they did not follow any classification systems for COPD, with 6.7% /14.8% indicating that they did not use any treatment classification system ( $p = ns$ ). Physicians reported prescribing the following medications to these proportions of their severe/ very severe patients: short-acting beta-agonists (SABA; for severe patients: 85.2% $\pm$ 26.8%/for very severe patients: 85.9% $\pm$ 27.9%), long-acting

anticholinergics (LAMA; 66.5% $\pm$ 28.4%/72.7% $\pm$ 29.0%), long-acting beta-agonists (LABA; 46.4% $\pm$ 39.2%/49.4% $\pm$ 39.7%), inhaled corticosteroids (ICS; 44.2% $\pm$ 37.4%/49.4% $\pm$ 39.7%), fixed dose combination ICS+LABA (31.7% $\pm$ 35%/36.7% $\pm$ 39.1%); oxygen therapy (33.8% $\pm$ 27.0%/59.3% $\pm$ 31.0%), and/or short-acting anticholinergics (SAMA; 20.5% $\pm$ 24.1%/23% $\pm$ 27.5%). PULMs (vs. PCPs) reported prescribing LAMA, LABA, combination ICS+LABA and SABA to a greater proportion of their very severe patients, while PCPs (vs. PULMs) were more likely to prescribe LAMA, SABA and combination ICS+LABA to their severe patients (all  $p < 0.05$ ). Physicians who reported not following any treatment guidelines ( $n=11$ , 11.1%) were less likely to prescribe SAMA for severe COPD patients and more likely to prescribe SAMA for very severe COPD patients.

**Conclusion:** Understanding current treatment patterns and uptake of available guidelines is an important first step to gauging the potential impact of new interventions to manage COPD, a condition characterized by high morbidity and mortality. Physicians who treat COPD patients estimated frequent exacerbations, with the rate of patients experiencing exacerbations increasing with COPD severity. This clearly estimates the burden of this highly prevalent condition, despite available maintenance therapies.

**3-105**

**Category:** General Clinical Practice

**Title:** Pharmacy clinical video telehealth (CVT): development and implementation of services within a Veterans Affairs health care system

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**Purpose:** The role of the clinical pharmacy specialist (CPS) has grown tremendously over past years. Literature studies support that clinical pharmacist services improve health outcomes, access to care, patient satisfaction/safety and continuity of care. As pharmacy clinicians, we are constantly looking for new and innovative ways to provide patient care. The veteran patient population also continues to grow, especially with our returning veterans from active duty. With this expansion of our patient population, especially in rural areas, we as clinical pharmacy specialists within our VA network (VISN 12) envisioned providing equal services to all patients no matter their distance from the main VA hospital. Hence, clinical pharmacists within VISN 12 developed and expanded clinical pharmacy services provided via clinical video telehealth (CVT). CVT is a subset of telehealth where clinical pharmacy services are provided to primary or specialty care via two-way interactive videoconferencing. It is a real-time interactive communication between patient and provider at two different locations.

**Methods:** The program lead on this project consulted with existing clinics and the VISN 12 telehealth coordinator to formulate a process for expanding CVT pharmacy services. A pharmacy CVT clinic set-up checklist was developed and shared with all prospective sites to standardize processes. Pharmacy CVT clinics have been established and there are now four sites within our VISN providing such services. In order to assess clinic growth, pharmacy CVT workload was captured. One of our VISN sites has completed outcome data assessing the change in HgA1c of patients managed by the diabetes pharmacy CVT clinic versus the pharmacist managed in-person clinic.

**Results:** The four sites within our VISN provide a variety of pharmacy CVT services. The VISN site established in January 2012 provides heart failure (HF), diabetes mellitus (DM), hypertension (HTN) and hyperlipidemia (HL) medication therapy management. The CPS is located at the main hospital site and the patient is located at the community based outpatient clinic (CBOC). A second VISN site was established in February 2012 and provides pharmacy CVT services to the womens health clinic in the areas of DM, HTN and HL. The CPS is located at the main hospital site and the patient is located at one of seven CBOCs. Another VISN site

provides pharmacy CVT services to the general medicine clinics in the areas of DM, HTN, HL, thyroid abnormalities, chronic obstructive pulmonary disease, asthma, smoking cessation, HF and medication management. A fourth site within our VISN provides psychopharmacology medication management services to five CBOCs. The importance of clerical and nursing support was also realized in providing pharmacy CVT services; they can help with scheduling, obtaining vitals and setting up the equipment at the patient site. Clinic visit workload capture for pharmacy CVT visits has increased since inception of new pharmacy CVT clinics. There has been a 32% increase in pharmacy CVT workload in fiscal year 2012 quarter two versus quarter one. The outcome data from one of our VISN sites has shown the average reduction in HgA1c after six months for telehealth (0.88%) versus in-person group patients (1.10%, p=0.46) to be similar.

**Conclusion:** Pharmacy CVT services have been implemented and expanded within VISN 12 and provide an innovative and effective service to our veteran patients. The utility of these services continues to increase as noted by our workload capture. Patient outcome data from one of our VISN sites helps to validate the efficacy of these clinics. VISN 12 will continue to collect workload capture data and performance improvement measures as well.

**3-106**

**Category:** General Clinical Practice

**Title:** STUDENT PHARMACIST INTERVENTIONS ON A GENERAL MEDICINE  
ADVANCED PHARMACY PRACTICE EXPERIENCE

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**Purpose:** The American College of Pharmacy Education (ACPE) accreditation standards require Doctor of Pharmacy programs to provide opportunities to perform patient-centered care in a variety of settings. Inpatient Advanced Pharmacy Practice Experiences (APPEs) provide pharmacy students the opportunity to participate on a multidisciplinary healthcare team and are given the daily responsibility of monitoring drug therapy for hospitalized patients and making any necessary interventions. Pharmacy students have demonstrated value to patient care teams with regard to cost savings, optimization of drug therapy, and minimization of side effects.

**PURPOSE:** To evaluate and demonstrate the value and quality that student pharmacists contribute to patient care as part of an interdisciplinary patient care team.

**Methods:** Retrospective analysis of interventions documented by student pharmacists from the University of California, San Francisco (UCSF) and University of Southern California (USC) Schools of Pharmacy who completed a six-week general medicine APPE at Cedars-Sinai Medical Center (CSMC) between January 1, 2010 and September 23, 2011. Study investigators categorized interventions based on: Type of intervention, intervention acceptance rate, and acceptance rates based on intervention types. Exclusion criteria for interventions: Drug information provided by the student pharmacist to the treating physicians and therapeutic recommendations that were specifically requested of the student pharmacist by the treating physicians

**Results:** A total of 678 interventions met inclusion criteria affecting 486 patients. Of the 545 (80.4%) accepted interventions, 289 (53%) interventions were considered to optimize a patients therapy, while 256 (47%) were considered to minimize or prevent medication errors. Highest acceptance rates involved: Vaccinations (100%), Therapy duration (91.3%), and Medication reconciliation (91.2%). Lowest acceptance rates involved: Antimicrobial de-escalation (71.8%), Frequency adjustments (68.4%), and documented drug allergies (66.7%).

**Conclusion:** Students serve as an extension of pharmacists by participating in direct patient care activities and are of value to the multidisciplinary healthcare team. Students can have better access to patients and medical teams; and make evidence-based, patient-specific clinical decisions. Student pharmacist involvement may allow pharmacists to spend less time contacting physicians to clarify, change, or discontinue a medication order because of the student

pharmacists accessibility to their teams. Pharmacists may allocate this additional time to other clinical or administrative duties to maximize the quality and quantity of patient care. Involving student pharmacists on these teams is beneficial because students are able to apply their knowledge in a clinical setting, pharmacists are able to impact more patients, and patients receive a more direct and higher standard of care; and these activities will integrate APPE students into the new Pharmacy Practice Models initiative

**3-107**

**Category:** General Clinical Practice

**Title:** Utilizing a Clinical Pharmacist to Impact the Safety and Quality of Care in the Medication Reconciliation Process.

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**Purpose:** To increase patient safety and quality of care by improving the medication reconciliation process utilizing a Clinical Pharmacist working with key community partners. This project served a rural and largely poor, medically underserved population in Clinton County, New York.

**Methods:** A Clinical Pharmacist was assigned to ensure accurate and complete medication reconciliation for patients admitted to CVPHMC upon admission and discharge. Baseline data for completion was assessed through Clinical Pertinence Review. Baseline data for accuracy was gathered through review of 564 patient charts admitted between in July 2009. The Pharmacist evaluated the home medication list (generated by nursing) used to complete medication reconciliation for errors and omissions. Number of medications, errors and omissions, and type of errors and omissions were recorded. Only chronic, prescription medications were included. Drug name, dose, route of administration, directions, and last time of administration were reviewed for each medication. Data was archived and results were calculated using Microsoft Excel. After collection of baseline data, work began on the other objectives. A daily census was used to identify new patients. Home medication lists used for reconciliation were evaluated for accuracy and the completeness of the medication reconciliation tool was analyzed. Errors and omissions were corrected and admission medication reconciliation completed by the pharmacist. Patients for discharge were identified through daily contact with Case Managers and attendance at discharge planning rounds. Upon discharge, the pharmacist reviewed discharge medication reconciliation tools for accuracy and completeness. Errors and omissions were corrected and discharge medication reconciliation was completed by the pharmacist. Weekly meetings were held with a Nurse Liaison from the Clinton County Health Department (CCHD) to strengthen community partnerships and improve patient safety through the medication reconciliation process. Patients medication needs and concerns were addressed during these meetings. Data was collected in October 2009, January 2010, and May 2010 to assess project progress and success.

**Results:** At baseline, 89 percent of patients had evidence of complete medication reconciliation upon admission while 86 percent of patients had evidence of complete medication reconciliation upon discharge. The 564 CVPHMC inpatient charts reviewed for baseline data contained 3,925 home medications. Review of these medications revealed 2,598 errors and omissions. This

equates to 0.66 errors/omissions per medication and 4.61 errors/omissions per patient. Type of errors/omissions observed can be seen in Table 1. A final review in May of 2010 revealed that 95.8 percent of patients had evidence of complete medication reconciliation upon admission while 95.6 percent of patients had evidence of complete medication reconciliation upon discharge. A total of 288 charts with a combined number of 1,568 medications were reviewed in May 2010 for accuracy. Of the medications reviewed, 379 errors and omissions were found. This equates to 0.24 errors/omissions per medication and 1.32 errors/omissions per patient.

**Conclusion:** Including a pharmacist in the medication reconciliation process improved accuracy and completeness of the medication reconciliation tool well beyond project goals.

**3-108**

**Category:** General Clinical Practice

**Title:** Evaluation of an inpatient alcohol withdrawal protocol

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**Purpose:** Alcohol withdrawal syndrome (AWS) occurs as a result of discontinuation or reduction of prolonged, heavy alcohol use resulting in symptoms. Benzodiazepines are first line therapy for managing these symptoms. These medications can be administered by one of two regimens, fixed-schedule or symptom-triggered therapy. These two approaches are equally effective. However, several studies have shown that symptom-triggered therapy results in the administration of less total medication and shorter duration of therapy. The primary objective of this study was to develop and implement a protocol that uses the Clinical Institute of Withdrawal Assessment (CIWA-AD) scale and symptom triggered medication. Secondary objectives included comparing the length of stay before and after the protocol implementation and any associated cost-savings.

**Methods:** The investigational review board approved this retrospective and prospective study. Patients who were nineteen years or older with a diagnosis code of alcohol withdrawal admitted to two general medicine units from December 2010 to March 2011 were included in the retrospective review of alcohol withdrawal prior to protocol implementation. Patients treated for alcohol withdrawal in the same two general medicine units from January to March 2012 were included in the prospective review of the implemented protocol. Patient demographics in addition to length of stay were recorded. The milligrams of benzodiazepines used in each patient to treat AWS were tabulated and converted to lorazepam equivalents for comparison between the groups.

**Results:** Forty patients were included in the retrospective review. Forty-nine patients were included in the prospective review of the implemented alcohol withdrawal protocol. The patient demographics for all eighty-nine patients were similar. In the retrospective group, patients used an average of 37.5mg lorazepam equivalents during their admissions while prospective patients used an average of 12mg lorazepam equivalents. Both groups had an average length of stay of five days. In the retrospective group, 12.5% (5/40) of patients required no lorazepam equivalents during their admissions, while in the prospective group, 33% (16/49) of patients required no lorazepam equivalents during their admissions. The majority of patients in the retrospective group (60%) were prescribed a combination of both a scheduled and an as needed benzodiazepine. In the retrospective group, the cost of lorazepam per patient stay was \$9.75 and \$3.12 in the prospective group. In addition, \$2,664 per patient stay was spent in the retrospective group on multivitamin, thiamine, and folic acid bags while \$652.68 was spent per prospective patient stay.

**Conclusion:** Prospective patients required three times fewer lorazepam equivalents than retrospective patients. More patients in the prospective group required no benzodiazepines. It can be inferred that many patients in the retrospective group, if placed on a symptom-triggered regimen like the prospective group, would not have required benzodiazepines. The lack of a difference in length of stay is likely due to the fact that UAB Hospital is not strictly a detoxification center. Both groups of patients were also being treated for other medical conditions in addition to possible AWS. During the 2011, 1303 patients were admitted to UAB Hospital with a diagnosis code associated with alcohol withdrawal. Adoption of the protocol hospital-wide could result in significant cost-savings.

**Category:** General Clinical Practice

**Title:** Pharmacists interventions do affect patient care: a study of interventions utilizing selected but clinically significant drug-drug interactions as a therapeutic measure

**Primary Author:** William A. Leelum, Staff pharmacist, Jackson South Community Hospital, 9333 SW 152nd St, Palmetto Bay, FL, 33157; Email: leelum\_william@bellsouth.net

**Purpose:** Detection of drug interactions between antiarrhythmics and agents that can potentially elongate the QTC interval, (thereby possibly induce torsades de point then ventricular fibrillation) or agents that can interact with linezolid thereby inducing serotonin syndrome are indicators for physician action. Agents that were chosen to be monitored which elongate the QTC interval are the fluoroquinolones, macrolides, specific antipsychotics and . specific antidepressants. Agents that interact with linezolid are the selective serotonin reuptake inhibitors(SSRI), norepinephrine and serotonin reuptake Inhibitors(NSRI).

**Methods:** A drug search for antiarrhythmics and linezolid is entered into the CERNER computer. Each patient profile is then scanned for interacting medications For linezolid interactions: physicians orders were obtained to discontinue the antidepressant or to change to an alternate antibiotic (vancomycin, daptomycin) .. For antiarrhythmics interactions :alternatives to the fluoroquinolones and macrolides are as follows: physicians orders were obtained for doxycycline in patients with pneumonia(to cover Atypical Mycobacterium). For a urinary tract infection an order for clotrimazole, nitrofurantoin, or a cephalosporin is obtained. For a perforated diverticulitis or colitis an order for ceftriaxone is obtained. For an antipsychotic: an order is obtained for an alternate antipsychotic which does not elongate QT interval.. For specific antidepressants (citalopram): discontinue the antidepressant

**Results:** Of a total of 290 patients were monitored ; 205 were on antiarrhythmics and 85 were on linezolid.. A total of 62 interventions were attempted 53 were with antiarrhythmics of which 45 were successful(a therapy change); 9 were with linezolid of which 9 were successful(a therapy change). The antiarrhythmics interactions involved 29 with fluoroquinolones, 15 with macrolides, 7 with antipsychotics and 2 with antidepressants. The interventions involved 2 cardiologists, 2 psychiatrists, 3 infectious disease and 12 internal med physicians :The linezolid interactions involved 9 SSRIs total, 6 were with citalopram, 2 with sertraline and 1 with venlafaxine. Involving 2 internal med, 2 infectious disease, 1 intensivist, 1 surgeon, and 1 psychiatrist. This study obtained a response rate of 26 percent for antiarrhythmics and 11 percent for linezolid Changes in drug therapy were obtained in 85 percent for antiarrhythmics and 100 percent for linezolid. The 15 percent of interventions that resulted in no change of therapy for antiarrhythmics were due to the fact that the patients had a pacemaker, defibrillator, had been on both interacting meds for a long period of time or cardiology had okayed the combination A possible reason for the low response rate for linezolid is the fact that, the agent is restricted to infectious disease physicians at this facility. Monitoring occurred from August 2010 to March 2012 in a 250 bed community hospital.

**Conclusion:** A need exists for pharmacists to monitor and intervene in patients with drug interactions between antiarrhythmics and agents that can potentially elongate the QTC interval. Also pharmacists must monitor and intervene in drug interactions between linezolid and SSRIs and NSRIs. This is to avoid increased hospital length of stay or admission into an intensive care unit resulting in increased hospital costs and possibly increased patient mortality..

**3-110**

**Category:** General Clinical Practice

**Title:** Pharmacy consultancy service in medical practices in Australia

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**Purpose:** The roles that a pharmacist can play in improving patient care are many and varied. These roles are continually expanding. The involvement of a pharmacist within a multidisciplinary healthcare team is a new model of practice for most medical practices. This poster describes the Australian model of pharmacy consultancy service in medical practices.

**Methods:** Medical practices on the Sunshine Coast, Queensland, Australia were approached via email through the local Division of General Practitioners in May 2010, requesting expressions of interest. A meeting was then arranged with the practice manager to discuss the process and a follow-up meeting with the principals of the practice. The model of practice includes promoting quality use of medicine through the Medicare Australia funded Home Medicines Review (HMR) program. An HMR consists of a general practitioner referring a patient to a suitably qualified pharmacist for a consultation either in the patients home or another location of the patients choice. During the consultation their medicines management is discussed and any appropriate recommendations will be made in writing to the general practitioner. A medicines management plan is then agreed on between the general practitioner and the patient. Further services provided in this model of practice include the supply of information directly to patients regarding the appropriate use of their medicines, general medicines information to doctors and nurses as well as responding to specific medicines-related queries and medicines-related education to doctors, pharmacists and nurses. A qualitative survey was undertaken in October 2010 to ensure the service was meeting the requirements of the practice.

**Results:** An initial service was commenced in one medical practice in Maroochydore in May 2010, followed by a second practice in Gympie in October 2011. This allowed the consultancy service to be established at a further two practices in Pomona and Cooroy in 2012. Three of the four practices are multidisciplinary in nature including doctors, practice nurses, diabetes educators and dieticians. A qualitative survey has been conducted with the seven general practitioners at Maroochydore and the results demonstrated 100% positive with respect to timeliness of reporting, detail in the report, language used, drug-related problems identified and relevance to patient management. General feedback obtained anecdotally from patients has also been positive. Some patients have recommended the service to friends and have invited the pharmacist to present to local community organizations about the service and quality use of medicines.

**Conclusion:** This new model of practice of a pharmacy consultancy service has been successfully implemented in four medical practices.

**Category:** General Clinical Practice

**Title:** Introducing clinical pharmacists at the acute medicine admission ward at Odense university hospital, Denmark, led to implementation of several interventions.

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**Purpose:** Introducing a new professional group into an existing health care team may be challenging. However, when the concept of new acute medicine admission wards was established in Denmark during the past years, the opportunity of introducing clinical pharmacists at the wards arose. In August 2009, clinical pharmacists were introduced at the acute medicine admission ward at Odense University Hospital. During 2010, the implementation process was adjusted to fit the setting, but since 2011 standardised clinical pharmacy services have been delivered continuously. Hence, the purpose of the current study was to evaluate the clinical pharmacists medication reviews at the acute medicine admission ward in 2011.

**Methods:** The main task of the clinical pharmacists at the acute medicine admission ward was to perform medication reviews 4 hours every day from Monday to Friday. If the medication review resulted in the identification of drug-related problems, the clinical pharmacists documented an intervention-note in the electronic patient chart, and according to the type of intervention, the note contained either a recommendation aimed at the physicians or, information about the intervention performed by the clinical pharmacist. When the patients were discharged from the hospital, the clinical pharmacists checked whether the interventions had been implemented by the physicians. All the drug-related problems that were identified by the pharmacists were registered in an electronic database. Based on the intervention-notes, the clinical pharmacists identified topics for education sessions delivered once a week to the ward physicians.

**Results:** During 2011, the pharmacists at the acute medicine ward reviewed 3,378 medication lists resulting in 2,501 interventions. The most frequent intervention delivered by the clinical pharmacists was regarding non-recommendations, which means that the pharmacists identified drugs that were not recommended to use in Odense University Hospital, and changed these drugs into a recommended alternative. The overall acceptance rate was 73% albeit varying from 93.7% for non-recommendations to 14.3% for adverse drug events. Low acceptance rate was identified for adverse drug events (14,3%) and registration of allergy (33,3%). Hence, these topics were, among others, included in the education sessions for the ward physicians.

**Conclusion:** The clinical pharmacy service at the acute medicine admission ward at Odense University Hospital resulted in a variety of interventions. The overall acceptance rate was 73% showing that the pharmacists interventions were well accepted at the ward. In addition, the registration and evaluation of the clinical pharmacists interventions were helpful in identifying education topics for the physicians at the ward.

3-112

**Category:** General Clinical Practice

**Title:** Implementation of an inhaler optimization program across three health-systems: infection rates and financial outcomes

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**Purpose:** Patient-specific metered-dose inhaler administration in the hospital can be inefficient and costly. A published method of administering a common inhaler using an individual holding chamber among multiple patients, termed the inhaler optimization program, has been described as an effective way to reduce pharmaceutical expenditures. However, this method of sharing metered-dose inhalers has been controversial and may lead to cross contamination and therefore, a theoretical risk of MRSA infection. The objectives of this study were: 1) to compare the MRSA infection rates pre- and post-implementation of the inhaler optimization program at several institutions and 2) to quantify the cost savings associated with this program.

**Methods:** Three healthcare systems within a regional pharmacy network in the Northeast adopted the inhaler optimization protocol. Each institution developed their own disinfection protocol and policy for administration and billing of inhalers. A multidisciplinary implementation strategy was developed, involving pharmacists, physicians, nurses, infection prevention practitioners and respiratory therapists. Institutional MRSA infection rates were tracked on a monthly or quarterly basis at least 6 months before and after implementation of the inhaler optimization program. The infection rates were compared using number of MRSA cases per 1,000 patient days and were analyzed using an unpaired t-test. Data were expressed as mean MRSA rates. Pre- and post- inhaler costs per patient day were recorded at least 6 months prior to and after the implementation of the program, with a 2-month washout period, approximately 1 month prior and 1 month after implementation. The cost savings associated with this program were analyzed as continuous data using a t test. P-values less than or equal to 0.05 were considered statistically significant. Factors contributing to the cost savings were explored, such as formulary standardization, changes in utilization patterns and the availability of disproportionate share hospital inpatient pricing for various inhalers.

**Results:** The mean MRSA rates for the 3 institutions pre-implementation of the inhaler optimization protocol were 0.23, 1.04 and 1.27, expressed as MRSA cases per 1,000 patient days and 0.08, 0.57, and 0.63, respectively, after implementation. This difference between MRSA infection rates before and after implementation of the inhaler optimization program was not statistically significant ( $p=0.11$ ,  $p=0.06$ , and  $p=0.45$ , respectively). The differences between

inhaler expenditures, adjusted for changes in patient census, before implementation for the 3 institutions were \$2.17, \$20.18, and \$4.69 per patient day versus \$2.26, \$20.69, and \$2.73 per patient day after implementation, respectively.

**Conclusion:** The inhaler optimization program does not appear to increase the institutional MRSA infection rates and may decrease inhaler expenditures, although the effect appears to range from cost neutrality to about 50% savings.

3-113

**Category:** General Clinical Practice

**Title:** Implementation of an electronic alert to improve thromboembolism prophylaxis at a community teaching hospital

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**Purpose:** 2008 estimates indicate that 350,000 to 600,000 Americans each year suffer from deep vein thrombosis(DVT) and pulmonary embolism(PE), and at least 100,000 deaths may be directly or indirectly related to these diseases. This study was conducted to determine if implementation of an electronic alert improved the rate of venous thromboembolism(VTE) prophylaxis of moderate to high risk medical-surgical patients.

**Methods:** A retrospective review of the medical records of all August, 2009 admissions to two nursing units was performed to determine if VTE prophylaxis was ordered for the medical-surgical patients by day two of admission. The results of this baseline data collection demonstrated a need to increase the rate of VTE prophylaxis. A multidisciplinary committee was formed to provide a plan to improve overall compliance. The VTE Committee developed an electronic alert that was designed to prompt prescribers if VTE prophylaxis was not ordered. The alert provided options for physicians to order prophylaxis or to explain why they felt VTE prophylaxis was inappropriate at that time. The alert displayed at the point where orders were electronically signed. This alert would only activate for the prescriber if pharmacologic prophylaxis was not ordered or one of the exclusions had not been documented. Six months after the electronic alert implementation, a follow-up retrospective study was conducted of the same two nursing units. The results of this study were used to determine if the electronic alert improved VTE prophylaxis compliance.

**Results:** An analysis of the combined data for the two nursing units resulted in an improvement in VTE prophylaxis of eligible patients from 76% in 2009 to 94% in 2011. Patients with medical resident coverage showed improvement in prophylaxis rate from 89% in 2009 to 96% in 2011. Patients without medical resident coverage had an improved rate of VTE prophylaxis of 92% in 2011 compared to 65% in 2009. Using a Chi Square test, all of these improvements were found to be statistically significant ( $P < 0.05$ ).

**Conclusion:** The results of this study showed that the implementation of an electronic alert along with physician education and nursing awareness resulted in an increased rate of compliance in VTE prophylaxis. While there was improvement in VTE prophylaxis compliance for all patients on the nursing units reviewed, the improvement was most noteworthy for those patients who did not have medical resident coverage. Continued education and awareness of the importance of

VTE prophylaxis along with refinement of the electronic alert should result in further improvement in this very important initiative.

**3-114**

**Category:** General Clinical Practice

**Title:** Development and implementation of a nurse driven pneumococcal and influenza vaccination protocol in a community hospital

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**Purpose:** In January 2012, the Joint Commission (TJC) and Centers for Medicare & Medicaid services(CMS) implemented new immunization core measures for pneumococcal disease and influenza prevention for hospitalized patients. These core measures align with the 2010 Centers for Disease Control and Prevention (CDC) recommendations for the prevention of pneumococcal disease in adults, children and infants as well as the CDCs recommendations for the prevention and control of influenza in adults, children and infants. The primary objective of the study was to develop and implement a nurse driven protocol for pneumococcal and influenza vaccination to achieve compliance with the TJC/CMS immunization core measures.

**Methods:** An interprofessional team was formed and a gap analysis of the current pneumococcal and influenza assessment and vaccination process was completed. The team leader was the assistant director of pharmacy, team members included nurses from adult & pediatric inpatient care areas as well as nurses from the emergency department, pharmacists from adult and pediatric areas, pharmacy buyer and representative from nursing administration (executive sponsor), quality reporting, medical staff services, and informatics. The gap analysis included a review of the current paper based order form which had been in place for several years, a review of the hospital's historical vaccination rate data, and modification of the assessment and ordering process to ensure compliance with current guidelines and immunization core measures. The proposed changes to the assessment and ordering process were approved by the medical staff, nursing and pharmacy department. The team also examined the impact the new core measures would have on the volume of vaccines purchased annually by the hospital. A tracking tool was developed for the pharmacy buyer to monitor quarterly purchase volumes of the vaccines. Once the protocol was approved hospital staff was educated regarding the the new immunization core measures and hospital protocol. The new protocol for assessment and ordering was implemented in December 2011. The team also identified the need for an electronic based protocol rather than paper. The electronic workflow was developed in parallel to the paper form and will be implemented after validation by the informatics team.

**Results:** The nurse driven pneumococcal and influenza protocol was implemented in December 2011. The January-March data for TJC/CMS immunization core measures for the hospital were reported as follows: IMM-1a Pneumococcal Immunization (PPV23) Overall 95%, IMM-1b Pneumococcal Immunization (PPV23) Age 65 and Older 97%, IMM-1c Pneumococcal

Immunization (PPV23) High Risk Population (Age 6-64) 90%, and IMM-2 Influenza Immunization 92%. The rate of pneumococcal immunization (PPV23) for high risk population (ages 6-64) was the lowest rate of the core measures. This is a new required patient population and represents an area for further improvement. The January-March 2012 overall pneumococcal rate of 95% is comparable to the 2008 rate of 96%. For influenza vaccination, the 2008 vaccination rate was 91% which is similar to the 2012 rate of 92%. However, in 2008 the data set did not include the pediatric patients. The revised process for assessment and vaccination of patients has resulted in rates of 90% or higher for the new TJC/CMS immunization core measures. The hospital goal is 100% compliance with the immunization core measures. The team meets monthly to review data and identify further opportunities for improvement.

**Conclusion:** An interprofessional team developed and implemented a nursing driven protocol for pneumococcal and influenza vaccination to ensure compliance with the new TJC/CMS immunization core measures. Utilization of the new process and protocol has resulted in compliance rates of 90% and greater for the immunization core measures. Future plans include the implementation of an electronic assessment and vaccination protocol to achieve 100% compliance.

### 3-115

**Category:** General Clinical Practice

**Title:** Pharmacist interventions provided in family practice: a systematic review

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**Purpose:** In recent years, pharmacists in many countries have integrated into family practices and established themselves as key members of the primary health care team. To evaluate the role of pharmacists within family practice, and their effect on clinical, humanistic and economic outcomes, we conducted a systematic review of published literature.

**Methods:** A systematic search of randomised controlled trials (RCTs) cited in the Cochrane Central Register of Controlled Trials (CENTRAL), Medline, EMBASE and International Pharmaceutical Abstracts was undertaken. Studies were included if clinical pharmacists: had a regular and ongoing relationship with the clinic; delivered an intervention aimed at optimising prescribing for, and/or medication use by, primary care clinic patients; and were physically present within the clinic for all or part of the intervention, or for communication with clinic staff. Only English language articles were included. After removal of duplicates and screening of titles and abstracts against inclusion criteria, two investigators independently reviewed full text copies, extracted data and assessed studies for methodological quality. Any discrepancies were discussed and sorted in the presence of an adjudicating investigator.

**Results:** 1167 articles were identified; 1136 were excluded leaving 31 studies in the final review. The majority of studies were undertaken in the United States (18; 58.1%), United Kingdom (5; 16.1%) and Canada (5; 16.1%). All studies involved interventions targeted towards patients, while some also targeted healthcare professionals. The most common interventions were medication reviews (28; 90.3%); medication education and counseling (22; 71.0%) and communication with patients health professionals (17; 54.8%). 80.6% of studies reported multiple outcome areas (clinical, humanistic and/or economic). Positive effects were reported in only 31.1% of clinical outcomes evaluated, 20.8% of humanistic outcomes and 15.4% of economic outcomes, with the remainder being of mixed or no effect. The most common areas where pharmacists had a positive effect were in blood pressure and diabetes management, quality of prescribing, medication adherence and consumer satisfaction. Only 35.5% of studies were assessed as being of high methodological quality.

**Conclusion:** Pharmacists provided a variety of interventions when integrated into primary care settings, with favourable results seen in certain areas of chronic disease management and quality

use of medicines. Future studies should employ more rigorous study methods and assess more reliable and relevant clinical outcome measures.

**Category:** General Clinical Practice

**Title:** Assessment of the Presence and Quality of Osteoporosis Prevention Education Among At-Risk Internal Medicine Patients

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**Purpose:** Appropriate calcium and vitamin D intake for the prevention of osteoporosis represents an important component of osteoporosis prevention education (OPE). We sought to assess the presence and quality of OPE among osteoporotic and at-risk inpatients.

**Methods:** This was a prospective chart review plus cross-sectional interview study conducted in adult inpatients determined to be at high risk of osteoporosis development. The study was conducted at a tertiary, referral academic medical center during the period of October 2010 through January 2011. A bedside interview tool was used to assess baseline education, OPE source, calcium and vitamin D intake, and presence of concomitant acid-suppressive therapy. Study investigators reviewed data and classified calcium and vitamin D intake as appropriate or inappropriate. Descriptive statistics were performed and the chi square test was used to analyze categorical data.

**Results:** 150 patients participated in the study and 39.3% of these reported not receiving any OPE. The other groups of primary OPE included healthcare providers (HCPs) and self (included media, friends/family, internet) in 31.3% and 29.3% of patients, respectively. Only 1 patient reported receiving education from a pharmacist. Appropriate overall calcium intake was found in 30.7% of patients with 51.3% of patients receiving the recommended amount of calcium, 48.7% receiving vitamin D co-therapy, and 21.3% taking an appropriate calcium salt. No statistically significant differences existed between primary OPE groups when rates of appropriate overall calcium intake or presence of vitamin D co-therapy were compared. Appropriate calcium intake was found in 77.8% of HCP OPE groups versus 37.9% for the OPE group ( $p < 0.0001$ ) and 48.8% for the self OPE group ( $p = 0.0048$ ). Patients in the HCP OPE group were found to have statistically significant lower rates of appropriate calcium salt selection than the no OPE group (31.6% vs. 66.7%  $p = 0.013$ ).

**Conclusion:** Patients with osteoporosis and risk factors for osteoporosis lack adequate education from healthcare providers regarding appropriate intake of dietary and supplemental calcium and vitamin D. A particular deficit was noted in pharmacist-provided education. Specific education targeting elemental calcium amounts, salt selection, and vitamin D intake should be provided to increase the presence of appropriate overall calcium consumption.

3-117

**Category:** General Clinical Practice

**Title:** Improving glycemic control: pharmacy protocol for the transition of intravenous insulin infusion to subcutaneous insulin

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**Purpose:** Community Hospital of the Monterey Peninsula became certified by The Joint Commission as a Center for Advanced Diabetes Care in 2011. In preparation for the certification, an effort was made to improve post-infusion glucose control in patients requiring intravenous insulin infusions. The hospital's multi-disciplinary Glycemic Management Team developed a Pharmacy Protocol for the Transition of Intravenous Insulin Infusion to Subcutaneous Insulin to standardize this conversion. The goal was to maintain blood glucose (BG) within the recommended ADA targets in the 24 hours after conversion. The Pharmacy Protocol standardized the calculation of subcutaneous (SQ) insulin based on the amount of intravenous (IV) insulin use and ensured an appropriate overlap of IV and long-acting SQ insulin. The objective of this study was to compare the ability to maintain glycemic control, defined as BG 100-180 mg/dL, between the Pharmacy Protocol and those transitions performed using current standard of care (physician directed).

**Methods:** The institutional review board approved this retrospective chart review of patients transitioning from IV insulin infusion, comparing those patients treated using the Pharmacy Protocol to those who were transitioned by the physician. Patients were excluded if they were transferred into the ICU, had an insulin SQ pump resumed, were immediately discharged after discontinuing the IV insulin infusion, or died. Data in the first 24 hours following transition was compared between groups with respect to the number of transitions, population average blood glucose, percentage and number of blood glucose readings between 100-180 mg/dL, above 250 mg/dL, between 41-70 mg/dL, below 40 mg/dL, and the number of IV infusion restarts.

**Results:** Patients had better glycemic control when transitioned using the Pharmacy Protocol (n=47) as compared to physician directed transition (n=35). The average Pharmacy Protocol BG was 181 mg/dL vs. 212 mg/dL for physician directed transition. A greater percentage of patients had BGs within the target range in the Pharmacy Protocol group vs. physician directed transition (48% vs. 29%). A larger number (47 vs. 34) and percentage (31% vs. 16%) of BG values were above 250 mg/dL in the physician directed transition group as compared to the Pharmacy Protocol group. There were more IV insulin infusion restarts (2 vs. 0) and a greater number of blood glucose readings between 41-70 mg/dL (7 vs. 2) in the Pharmacy Protocol group compared with physician directed transition. No blood glucose values were below 40 mg/dL in any patient group.

**Conclusion:** Standardizing the dose calculation of SQ insulin and ensuring overlap of IV and SQ insulin with the Pharmacy Protocol was more effective in maintaining glycemic control in the first 24 hours after transition, with few hypoglycemic events.

**3-118**

**Category:** General Clinical Practice

**Title:** Peeling Away Banana Bag Blunders: Implementation and Evaluation of a Standardized Process for Alcohol Detox Patients

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**Purpose:** Approximately 8 million people in the United States suffer from alcoholism. One complication of chronic alcohol use is thiamine (vitamin B1) deficiency, therefore thiamine supplementation has become a common practice for acute alcohol detoxification. When thiamine deficiency is coupled with dextrose administration it can result in Wernicke's Encephalopathy (WE). Giving thiamine to those patients who are suspected of being deficient, prior to the administration of dextrose, is an essential step in preventing WE. Such patients must also continue to receive on-going thiamine supplementation. Intravenous (IV) or intramuscular (IM) administration of thiamine is usually the preferred route in patients suffering from acute alcohol detoxification. The purpose of this study is to evaluate the implementation of a standardized process for administration of IV banana bag (thiamine, folic acid, and multivitamin in IV fluid) in alcohol detoxification patients.

**Methods:** All banana bag orders were evaluated retrospectively over a total 3-month period prior to and after the implementation of a standardized process for ordering, preparing, and administering banana bags. The patient's electronic medical record (EMR) and pharmacy IV preparation log were reviewed to identify the site of IV preparation (IV hood per USP 797 versus nursing ward). The patient's EMR was then reviewed to verify administration through Bar Code Medication Administration (BCMA) scanning and timing between bags. The VA-TAMMCS (Vision, Analysis, Team, Aim, Map, Measure, Change, Sustain) improvement framework was utilized via swim lane maps to review the entire process from provider medication order entry to medication administration. Processes were then modified and standardized using system redesign strategies to improve patient care, reduce medication errors, and enhance clarity of medication orders.

**Results:** The results collected prior to the implementation of a standardized process, were used to make improvements to medication orders, IV preparation, and administration processes. The following standard practices were implemented to reduce medication errors. Provider order sets were modified to give providers the option of running an IV banana bag as a piggyback, scheduled once daily separate from IV maintenance fluids. Nursing alerts were also created, which prompted the nurse to hold maintenance IV fluids during the banana bag infusion. The total number of banana bags ordered during the study period was 148. Of those 148 bags, 32 (21.6%) were made by nursing staff. After implementation of the standardized process, the number of banana bags made outside of the IV hood was reduced to zero (0%). This was

accomplished by updating provider order sets to recommend a now dose of intramuscular thiamine and starting the banana bag the next day during pharmacy hours. The individual ingredients used to prepare the banana bag were also removed from the automated dispensing systems on the nursing wards. Further review of the results showed an increase in the number of banana bags ordered being administered to patients. Staff education regarding new the process was provided via staff in-services, emails, and one-on-one discussions.

**Conclusion:** Standardizing the ordering, preparation, and administration of banana bags for patients admitted for alcohol detoxification has reduced the discrepancies between the banana bag ordered and their administration, reduced confusion between services, and eliminated preparation outside of the IV hood. Continuous quality analysis and process improvement will help improve patient care and further reduce medication errors.

3-119

**Category:** General Clinical Practice

**Title:** Impact of medication education rounds performed by pharmacy students and residents on patient satisfaction in a community hospital

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**Purpose:** Patient satisfaction scores, measured by the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), are an important tool used to assess the provision of care. It has been previously identified that pharmacists can improve patient satisfaction scores via medication counseling activities. The current study aims to determine the effect of pharmacy student and resident led medication education rounds on HCAHPS scores.

**Methods:** After an orientation period, pharmacy students were assigned to 1 of 3 units. After completing morning rounds, students were responsible for educating patients regarding the name, indication and common side effects of their medications. Students were encouraged to educate at least 5 patients per day. During months with no student coverage, pharmacy residents completed a Patient Education rotation to maintain the program. Data collection began on March 1, 2011 and was completed on March 31, 2012. Mean HCAHPS percentile rank for medication education during this time period was compared to the 12 month period immediately prior to the initiation of medication education rounds using the student's t test. Correlation between number of patients educated and mean HCAHPS percentile rank was calculated with linear regression.

**Results:** A total of 1,192 patients were educated by pharmacy students and residents, or about 21.1 percent of total inpatients on the selected units. Mean HCAHPS percentile ranks for the 12 month period of student and resident rounding were significantly higher than the 12 month period immediately preceding the implementation of the program (58th percentile vs 37th percentile,  $p=0.03$ ). Linear regression demonstrated a moderate correlation between the number of patients educated by pharmacy students and residents with HCAHPS percentile rank ( $r=0.36$ ), though the correlation was not statistically significant ( $p=0.08$ ).

**Conclusion:** Pharmacy students and residents had a significant positive impact on patient satisfaction with medication education by performing daily medication education rounds. Utilizing students and residents in this setting may facilitate demonstration of the value of pharmacy services when pharmacists have many competing clinical responsibilities.

**3-120**

**Category:** General Clinical Practice

**Title:** Learning new tricks: an assessment of novel versus a traditional patient counseling strategy

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**Purpose:** A pharmacy faculty member from the department of pharmacy practice introduced Coumadin Rap Song on YouTube as a musical video learning tool. The primary intent of this video was to provide an entertaining platform to educate viewers on warfarin usage. This research aimed to determine the most effective method of learning the material presented in the anticoagulation video. The purpose of this study was to determine if there is a difference between a novel, video based counseling (VBC) and a traditional, verbal discourse counseling approach to patient education.

**Methods:** Institutional review board approval and informed consent were obtained prior to study initiation. The inclusion criteria were non pharmacy students, persons 18 years of age or older, and lack of familiarity with warfarin based on an open ended question. Regular recruitment sessions occurred on the campus of the participating university. Screening sessions for inclusion were performed on an individual basis. Fifty subjects were enrolled and randomized to either the VBC group or verbal discourse group. Subjects in the VBC group viewed the musical video learning tool which was approximately 4 minutes in length. Pictures were incorporated throughout the video session that underscored pertinent educational points. Participants assigned to the verbal discourse group received a scripted four minute informational session. The counseling points conveyed during this session were derived exclusively from the music video. A pre and post assessment of 10 questions with identical content was administered to the subjects. The post assessment questions were rearranged to protect against recall bias. Assessment items were written at a 6th grade reading level. No time limits were imposed on participants during the assessment periods.

**Results:** Twenty six subjects were randomized to the VBC group whereas 24 subjects were randomized to the verbal discourse group. There was a 10 percent difference in performances on post counseling assessments observed between the VBC and verbal discourse groups. This difference did not demonstrate statistical significance (95 percent CI, 0.00 percent to 20.00 percent, P equals 0.1828).

**Conclusion:** VBC was shown to be just as effective as verbal counseling. This design represents a paradigm shift in respective approaches to patient education. VBC provides an avenue for fostering more informed questions on behalf of patients to their pharmacists and other healthcare providers tailored to their medical conditions. This feature is also slated to facilitate subject matter retention through repeated exposure to this medium. Future studies will seek to employ similar research methodologies in patient populations prone to warfarin use.

**3-121**

**Category:** General Clinical Practice

**Title:** Development and implementation of an education program to increase clinical competencies of pharmacists

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**Purpose:** The consensus statement of the pharmacy practice model initiative (PPMI) summit recommends hospital and health system pharmacists to be responsible and accountable for patients medication related outcomes and for pharmacists to practice at the top of their licenses. At our facility, a need was recognized for additional training for staff pharmacists to take on expanded, integrated roles within our hospital. This project was designed to identify and correct gaps in staff pharmacists clinical skills to allow them to practice in an integrated role at a small community hospital.

**Methods:** After determining the integrated pharmacists duties, the PPMI work group at our hospital recognized areas in which staff pharmacists required additional training through the utilization of needs assessment surveys that identified knowledge gaps. Pharmacists with advanced training (residency, board certification) were chosen to develop and lead education sessions in their respective areas of expertise and evaluate the training pharmacists. Education sessions were given in one of three methods: didactic lectures, self-learning modules, and mentoring. Competencies of pharmacists were measured for patient counseling and patient profile reviews. Competency assessments were given on a routine basis to ensure topics were being understood and to further identify gaps in knowledge. The assessment examinations were case-based and involved both written and oral examination components. The written examinations required the pharmacists to create patient problem lists and correctly assess all medication-related problems. All staff pharmacists were required to complete the assessments. Assessors were trained in oral examination skills and in evaluating the required competencies. Pharmacists were given written and verbal feedback on each assessment with specific recommendations for improvement. Pharmacists were required to have all competencies completed by the end of the three month training period.

**Results:** Fourteen pharmacists completed the training sessions and competency assessments. The pharmacy director and clinical coordinator felt the competency assessments were successful in detecting gaps in knowledge. Pharmacists completing training indicated that case-based mentoring sessions were more effective than didactic teaching in increasing competency levels, but they preferred having a combination of self-learning material, didactic teaching and mentoring. Pharmacists also indicated they were more confident in their clinical skills after completion of the training modules.

**Conclusion:** A robust education program with didactic, self-learning and mentoring components is an effective way to train inpatient staff to take on more clinical duties within the department of pharmacy. Certification modules in anticoagulation, antimicrobial stewardship, diabetes management, and pharmacokinetics are being developed with separate, individual assessments to further develop integrated pharmacists and to allow them to have expanded privileges.

**Category:** General Clinical Practice

**Title:** The Role of Pharmacy in Clinical Order Set Management, Standardization and Optimization across 11 hospitals

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**Purpose:** In late 2009 Sisters of Charity of Leavenworth Health System (SCLHS) an 8 hospital system in the states of Colorado, California, Kansas and Montana became the sole sponsor for the Exempla Healthcare System which manages 3 hospitals in the Denver Colorado area. The existence of diverse levels of differentiation between the 11 sites and the decision to adopt the computerized order entry (CPOE) system built by the 3 Exempla sites, exemplified the need to standardize order sets. Increasing use and evolutions in practice place greater strain on the modification process and places more of a demand on standardization. Each go-live creates greater resistance to the adoption of practices considered someone else's. There was great concern that requests for order set changes could soon outpace the constrained resources of Information Technology (IT) and waning clinician involvement in this process creates a credibility threat. Early identification of potential threats brought together clinicians, pharmacy and IT to assess current state and propose improvement opportunities.

**Methods:** After thoughtful discussion it was decided that a new group be formed with heavy clinical input and system wide membership. The Order Set Management Group (OMG) is formed to evaluate and prioritize clinical order set requests, assemble subject matter experts to assess evidence and best practices, address regulatory compliance, gauge an appropriate reduction in system-wide variation, approve the build products and plan for dissemination of changes. It is recognized there may be an opportunity to increase the scope of the OMG group in the future but initial efforts will focus on clinician driven requests for order sets. The process evaluation team identified several goals for optimal order set management that are being incorporated in the OMG charter:

- o Order sets need to make sense and need to follow workflows and commonly accepted practices (i.e. foley catheters not listed first)
- o Make clinicians more efficient
- o Order sets should be designed to reduce confusion and completion times
- o Make clinician more effective
- o Order sets should mimic accepted care pathways when possible, serve as memory aids and reduced unwarranted variation in patient care
- o Meet regulatory requirements
- o Order sets should increase regulatory compliance and encourage required care management documentation
- o Share best practices
- o Order set development and optimization should seek best practices in and out of SCL and be amenable to modification based on appropriate feedback and data
- o Update with evidence
- o Input from subject matter experts should be based on current evidence as well as consensus of their constituents and specialties

Cost consideration o Order sets should include cost considerations when applicable as determined by the SCLHS System Pharmacy and Therapeutics Committee (PT2)

**Results:** The first meeting of the OMG was held the second week in April and continues to meet weekly. The team has established the following and will be presented: □ Team make up and selection o Physician representation from each care site as identified by the site CMO o 6-regional nursing clinical informatics representatives as identified by the CNOs o 2 Pharmacist(s) act as support for committee o Clinical architect □ Team Charter □ Process Flow diagrams Future state - displays a simplified system and modifications will be made as the group works through the new process □ Prioritization Matrix- Order set development and modification will be prioritized by OMG. □ Consensus tool- An ordinal consensus tool has been developed for use when binary consensus can not be met. □ Responsibility Matrix- Team members have great responsibility and accountability. To ensure optimal functioning of the OMG an accountability matrix was developed.

**Conclusion:** The purpose of the OMG is to create a team of clinicians, ancillary services and IT professionals to oversee order set development and optimization and to promote a consistent and timely process that restores credibility to the balance of standardization and autonomy. There is great anticipation that the alignment, from system to site, will be recognized and that site level opportunity for input will be matched by their accountability.

3-123

**Category:** General Clinical Practice

**Title:** Evaluation of a pharmacist led medication reconciliation and education program in patients with dyslipidemia

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**Purpose:** A pharmacy initiated medication reconciliation (MR) and disease state education program was developed in an effort to improve medication adherence and LDL cholesterol levels in patients with dyslipidemia.

**Methods:** This study was approved by the institutional review board at the Veterans Affairs (VA) Boston Healthcare System. Medication reconciliation was performed by a member of the pharmacy team upon hospital admission to patients with a diagnosis of dyslipidemia with an LDL level elevated above goal. Education regarding cholesterol management and medication adherence was also provided to each patient prior to discharge from the facility. Patients placed in the intervention group were then contacted by the pharmacy team via telephone two to four weeks post discharge for a follow up MR and further patient education. This telephone conversation focused on adherence to the patients post-discharge medication regimen and the perceived benefit of discharge education. Patients refill history and fasting lipid panel (FLP) were followed for a period of nine months in order to determine if the patient remained adherent to lipid lowering medication as well as if the patient education component resulted in a lowering of LDL cholesterol levels.

**Results:** A total of 2368 patients were screened between August 2010 and February 2012. Only twenty patients however met inclusion criteria and provided informed consent. Included patients were then separated into either the intervention group or control group (ten patients per group). One hundred percent of the subjects were male with an average age of 64 in the intervention group and 68 in the control group. 60% of patients in the intervention group were able to be reached via telephone for follow up MR. All patients within the intervention group who had a repeat LDL level drawn within 9 months had a decrease in LDL level. Additionally, 62% of patients in the intervention group achieved their target LDL within 9 months of interaction with the pharmacy team where as 0 patients in the control group achieved their target LDL level. This service was also well perceived by patients within the intervention group with an average score of 3.6 out of 5 for overall benefit of this service.

**Conclusion:** This study suggests that a pharmacy led initiative for counseling patients regarding cholesterol management can be beneficial in patients achieving LDL goal and that this service was also well perceived by patients. Our study was limited by a small sample size and also

required a significant utilization of resources. Future studies should be performed to evaluate a more diverse patient population across multiple disease states.

**Category:** Geriatrics

**Title:** Therapeutic substitution of long acting beta agonist/ corticosteroid metered dose inhalers with aformoterol and budesonide via nebulization at a 210 bed urban hospital

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**Purpose:** Treatment of asthma and COPD is a common indication for use of metered dose inhalers containing long acting beta agonists and corticosteroid (LABA/Cort MDI). LABA/Cort MDI require a moderate level of co-ordination on the patients part to administer correctly. Our institution has a large elderly population that has difficulty in self administering metered dose inhalers (MDI). Previously at our institution, LABA/Cort MDI: fluticasone/salmeterol or budesonide/formoterol were highly utilized agents to treat asthma/COPD. In a medication usage evaluation performed in conjunction with the respiratory care department, it was found that the majority of our elderly patients were not able to effectively self administer the LABA/Cort MDI ordered.. We describe our experience with a novel therapeutic substitution for treatment of asthma/COPD utilizing aformoterol/budesonide (AFOR/BUD) via nebulizer.

**Methods:** The pharmacy department investigated alternatives to LABA/Cort MDI and decided on a nebulized treatment which comprised of aformoterol and budesonide (AFOR/BUD). Aformoterol, a long acting beta agonist indicated for COPD and budesonide, a corticosteroid indicated for pediatric asthma, both available as a nebulized solution were chosen as an alternative to LABA/Cort MDI. While use of AFOR/BUD nebulized solution is more costly per day versus LABA/Cort MDI (\$21.00 per day vs. \$10.00-12.50 per day). AFOR/BUD via nebulizer is available in unit dose which is stocked in our institutions automated dispensing cabinet versus LABA/Cort MDI which is supplied as a 7 day supply bulk container that needs to be dispensed from the pharmacy. The therapeutic substitution was approved by the respiratory care, pharmacy and therapeutics and the medical executive committees. Alternatively, physicians could prescribe dispense as written and obtain LABA/Cort MDI for their patients.

**Results:** The therapeutic substitution utilizing AFOR/BUD via nebulizer for LABA/Cort MDI was instituted in April 2011. Since its introduction of substituted therapy, there have not been any reports of serious adverse events or treatment failures reported at our institution resulting from the change in agents or method of administration. Additionally, cost savings by the institution were realized. Prior to the therapeutic substitution the cost per year for LABA/Cort MDI and AFOR/BUD nebulizers was \$38,000. After the initiation of the therapeutic substitution the following year costs decreased to \$20,000, saving \$18,000 per year.

**Conclusion:** AFOR/BUD via nebulizer is a viable option for the treatment of asthma/COPD at our institution, particularly for elderly patients not able to self administer a metered dose inhaler. Cost savings were realized as the therapeutic substitution utilizes a unit dose product which eliminates waste and the loss of inhalers associated dispensing bulk containers for patient use. Close cooperation between Pulmonologists, Respiratory care, and Pharmacy were instrumental in the success of this novel therapeutic substitution

3-125

**Category:** Geriatrics

**Title:** Inhaler compliance and awareness in the elderly

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**Purpose:** The objective of this study was to investigate the relationship between compliance and awareness about inhalation therapy in elderly patients and develop the various education program.

**Methods:** . The participants in this study were 163 out-patients, a 30-item survey for patient-reported variance in the use of inhalers prescribed. This survey reviews tests the concurrent and predictive validity of a structured 4-item self-reported compliance measure, and included questions about inhaler use and reasons for using inhalers differently than prescribed. Survey responses were compared between patients reporting no variance vs. variance from prescribed instructions. Chi-squared analysis and Logistic regression were used to determine predictors for variance.

**Results:** The mean age of responders was 73.5 years (SD) with 74% male, 58% ex-smokers, and 68% with COPD. Overall, 43.6% of the elderly patients reported compliance and 56.4% was non-compliance. The types of omission were forgetting(38.7%), carelessness(19.6%), stopping the drug when feeling better(16.6%), stopping the drug when feeling worse(4.3%). In analyzing the Chi-square analysis, there highlighted those factors which significantly influenced compliance, sex( $p=0.017$ ), ex-smoking( $p=0.028$ ), positive recognition about inhalation therapy( $p<0.001$ ). Also the number of inhaler( $p<0.001$ ) and experience of inhalation education( $p=0.004$ ), the number of times being educated( $p=0.002$ ) were significant correlation. A 5 variable compliance model was obtained from logistic regression analysis. The factors shown to influence compliance were sex, experience of inhalation education, the number of education, the number of inhaler and positive recognition about inhalation therapy. The responders showed lower recognition rate and active attitude on managing adverse drug reaction. The number of experiencing side effect is 105 patients. The Form of education program what they want is various, for example public lecture, individualized education, information leaflet, etc.

**Conclusion:** We conclude that physicians and pharmacists need a basic understanding of elderly patients and a continuous monitoring of using inhaler and appearing adverse drug reactions. And there is necessary to develop various and effective educational programs for appropriate inhaler use and also to improve understanding of the disease and inhaler use through broad education programs for the elderly.

3-126

**Category:** Geriatrics

**Title:** Evaluation of the therapeutic conversion of galantamine to donepezil

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**Purpose:** The Pharmacy and Therapeutics Committee at the Ralph H. Johnson VA Medical Center (RHJ VAMC) approved an automatic conversion of galantamine to donepezil in patients with Alzheimers disease. The purpose of this study was to evaluate if there is a difference in cognitive function, activities of daily living (ADLs), tolerability, and cost before and after the conversion from galantamine to donepezil.

**Methods:** The institutional review board approved this medication use evaluation. The study population included patients enrolled at RHJ VAMC who were converted from galantamine to donepezil between September 1, 2011 and December 31, 2011. Patients were excluded if they did not receive galantamine or donepezil from the VA Pharmacy, or did not have a Functional Assessment Staging Tool (FAST) score within the 24 weeks prior to and 12 weeks or more after the conversion. Differences in cognitive function and ADLs were determined by assessing the change in FAST scores before and after the conversion. Tolerability was assessed by identifying all documented adverse events directly attributable to donepezil. We annualized cost avoidance by comparing the cost of the study groups baseline dose of galantamine to the cost of donepezil.

**Results:** Thirty-nine patients had the same FAST score or progressed to the next FAST stage, and four patients had an improvement in their FAST score after the conversion. Six patients reported insomnia following the conversion. Converting 55 patients from galantamine to donepezil resulted in \$16,863.00-\$18,067.50 annual medication cost avoidance.

**Conclusion:** The conversion of galantamine to donepezil resulted in significant cost savings; however there was no statistically significant difference in the FAST score before or after the conversion.

3-127

**Category:** Geriatrics

**Title:** Implementation of a pharmacy resident driven clinical service for geriatric surveillance in a community teaching hospital

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**Purpose:** The focus of this study was to assess the value of implementing a clinical pharmacy service led by a pharmacy practice resident for geriatric surveillance in a community-based teaching hospital.

**Methods:** In this prospective study at HMC from January 2012 to March 2012, Quadrameds Computerized Patient Record (QCPR) system, was utilized to perform chart reviews by means of a clinical monitoring queue. The queue was created to capture patients 65 years of age or older admitted as an inpatient on the general medicine units with at least one active risk medication in patient profile. Risk medications were identified using the Beers and Screening Tool of Older Peoples potentially inappropriate Prescriptions (STOPP) Criteria based on HMC formulary and prescribing trends. Of the selected patients from the queue, those with multiple comorbidities and polypharmacy were screened and included. All other patients were excluded. Medication profiles were reviewed by a pharmacy resident to assess for interventions in the study patients and recommendations were made directly to prescribers.

**Results:** There were 44 patients included in the study and 21 patients excluded who did not meet criteria. The primary endpoint was the number of interventions a clinical pharmacy resident identifies based on potential risk medications. Secondary endpoints were the composite number of interventions based on non risk medications and cost savings. There were a total of 37 recommendations of which 23 recommendations were based on risk medications that were identified and 14 recommendations were based on non-risk medications. There was a total cost savings of 5,274 based on the completed interventions.

**Conclusion:** The study had determined that there is a role for a pharmacist providing and enhancing geriatric care.

3-129

**Category:** I.V. Therapy / Infusion Devices

**Title:** Implementation of a new outpatient infusion center: nine months later

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**Purpose:** Outpatient infusion centers have the capability to provide favorable clinical and economic advantages to hospitals and their patients utilizing their services. Since the opening in September, 2011, of a new outpatient infusion center located within the hospital, numerous patients have received intravenous infusions and subcutaneous and intramuscular injections. This project was implemented to identify various parameters associated with clinical and financial outcomes as well as patients' report of satisfaction with usage of the infusion center.

**Methods:** Data was collected and analyzed from financial reports, patient reports of experiences, and chart reviews for all patients that have utilized the services of the infusion center since its opening in September, 2011. The data review included revenue reports detailing reimbursement of medications and administration charges, payor mix, types of infusions, physician usage by specialty, referrals from the emergency department, physician awareness of infusion center, and adverse events experienced during medication administrations. Patient satisfaction scores were also analyzed.

**Results:** There were 532 patient charts reviewed by pharmacist or pharmacy student over the period from September 1, 2011 to April 30, 2012. During this period, 30% of the visits were for antibiotic therapy, 26% for biologic response modifiers, 14% for recombinant human erythropoietins, 13% for omalizumab (Xolair), 5% for osteoporosis medications (denosumab, zoledronic acid, ibandronate), and the balance were rehydration, migraine intravenous therapies, and other miscellaneous injectable medications. Physician types were also reviewed, with (in order of predominance) pulmonology, renal, neurology, and infectious disease being the specialties with the most usage. The net revenues for the first nine months have increased steadily over the period, with margins indicating net profits for the first year projected to be \$2 million.

**Conclusion:** Infusion centers provide a much needed and valuable service.

**Category:** I.V. Therapy / Infusion Devices

**Title:** Pharmacy led potassium chloride replacement protocol

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**Purpose:** Traditionally, the potassium replacement protocol at our system of six hospitals was managed by physicians and nurses. Potassium chloride associated adverse events resulted in protocol modification at our urban hospitals, and a medication use evaluation study at that time demonstrated a 55 percent protocol accuracy rate. Another medication use evaluation at go-live with the modified protocol, demonstrated a 72 percent accuracy rate, while a six-month study, demonstrated a 63 percent protocol accuracy rate. As a result of improvements in our clinical pharmacy program at one of our rural hospitals, we observed a surge in pharmacy consults from physicians for the potassium replacement protocol management. The Medical Executive Committee at this institution subsequently approved the pharmacy potassium dosing protocol. We received approximately three such consults per day over the past 18 months. We randomly selected and evaluated twenty-one patients managed by our pharmacists at this rural facility, and compared this to data from our urban facilities. Our experience in managing these patients is reported here.

**Methods:** Orders written for pharmacy to dose potassium chloride per protocol, were written by physicians, and scanned into our computer system. The clinical staff pharmacist on duty determined dosages for the patients, based on levels from the systems potassium replacement protocol. Since we do not have a 24-hour pharmacy operation, our remote order entry pharmacists were alerted to follow these patients after hours. Also, we do have pharmacists on call that would routinely come in after hours to dose and manage patients on these protocols, when either the remote order entry pharmacist cannot manage the patients remotely and the presence of a clinical pharmacist is needed onsite, to modulate therapy. Demographic and clinical data on these patients were collected on a data collection form, and retained in the pharmacy department. We compared our results to those of our urban institutions. We presented results to our system-wide Pharmacy and Therapeutics Committee.

**Results:** The mean initial potassium chloride level in the twenty-one patients was 3.2 millimoles per liter, (standard deviation of plus or minus 0.47, and 95 percent confidence level of 0.21 millimoles per liter). The mean potassium level post treatment by our pharmacists was 3.9 millimoles per liter (standard deviation of plus or minus 0.50, and 95 percent confidence level of

0.22 millimoles per liter). Mean total potassium chloride administered was 189.52 mellequivalents (standard deviation of plus or minus 136.84, and 95 percent confidence level of 62.28 mellequivalents). No levels in the toxic or sub-therapeutic ranges were observed post management. No severe adverse events were observed due to poor adherence to protocol. Thus we observed a 100 percent success rate in getting patients to the therapeutic range, when pharmacists managed the potassium replacement protocol at one of our rural hospitals. Our System-wide Pharmacy and Therapeutics Committee has recently recommended that pharmacists manage all potassium replacement protocols at all six hospitals.

**Conclusion:** A pharmacy-led potassium dosing protocol has been demonstrated to be successful in our small rural hospital of 120 beds. Our system-wide Pharmacy and Therapeutics Committee recently recommended that this should become the standard of practice throughout our system of six hospitals.

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**Category:** I.V. Therapy / Infusion Devices

**Title:** Impact of education and smart pump settings on vancomycin infusion rates and adverse drug events

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**Purpose:** Vancomycin is an effective antibiotic for treating gram positive infections in the hospital setting. It is generally well tolerated but has a unique adverse reaction known as Red Mans Syndrome that is often related to the rate of infusion. New vancomycin guidelines released in 2009 resulted in higher doses of vancomycin being used, and our healthcare system noted an increase in vancomycin related adverse reactions. Education on appropriate dosing, administration and monitoring of vancomycin was developed and implemented. Advances in smart pump technology also allows for setting limits on rates and concentrations used. This study is to evaluate the impact of education and altered smart pump settings on vancomycin infusion rates and the rate of adverse reactions to vancomycin.

**Methods:** This is a prospective, observational, quality improvement study. Approval to extract and present this data was obtained from the Institutional Review Board (IRB). Noting an increase in vancomycin adverse drug reactions in 2009, educational documents on dosing, administration and monitoring of vancomycin were developed by a subgroup of the system-wide antimicrobial stewardship team. This was approved by the system Pharmacy and Therapeutics (P&T) Committee in Dec 2010 and disseminated to all facilities in our integrated delivery system. In November 2011, smart pump settings were modified to change the maximum infusion rate of vancomycin at 1000 mg/hour from a soft limit which users can override, to a hard limit which cannot be overridden. In addition, the starting pump rate in most units was set at 600 mg/hr, with a soft limit override needed to increase past that point. Adverse drug reaction rates for vancomycin were evaluated for one year prior to and after the education was implementation starting in Dec 2010 and also prior to and after the pump setting changes were implemented in November 2011. In addition, pump overrides and rates of vancomycin used prior to and after the pump setting changes were evaluated.

**Results:** Comparing the year prior to and the year after the educational initiative, all vancomycin events were reduced by 13%, with a 37% reduction in adverse drug reactions and a 28% reduction in infusion related reactions. After adding the pump modifications the following year, an addition 43% reduction in vancomycin events was noted, including a 46% reduction in adverse drug reactions and a 49% reduction in infusion related reactions. Prior to the pump setting changes, in 704 (7.5%) vancomycin infusions, the nurse overrode the 1000 mg/hr soft limit, with those resulting in an average infusion rate of 1670 mg/hr. After this was changed to a

hard limit, this was still attempted 481 (7.1%) times, but increase in rate was not allowed by pump.

**Conclusion:** We found education to be modestly effective in changing behavior resulting in a reduction of vancomycin adverse effects. Changes in smart pump settings, such as hard limits, had a more significant effect on reduction of adverse events and an additional benefit even after educational efforts have been implemented.

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**Category:** I.V. Therapy / Infusion Devices

**Title:** Safety of compounded calcium chloride admixtures for peripheral intravenous administration in the setting of a calcium gluconate shortage

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**Purpose:** Calcium gluconate is the preferred salt for intravenous (IV) repletion of calcium deficiencies in the hospital setting due to lower potential for infusion site reactions compared to calcium chloride. In the setting of the recent national shortage of IV calcium gluconate, our institution implemented a compounded calcium chloride admixture for peripheral IV administration. The objective of this analysis is to evaluate the peripheral infusion site safety profile of locally compounded IV calcium chloride admixtures in adult inpatients.

**Methods:** A retrospective analysis of patients receiving intravenous calcium chloride repletion via peripheral IV access from April 1st 2011 to June 30th 2011 was approved by our institutional review board prior to data collection. Two compounded sterile product preparations of calcium chloride in 5% dextrose (600 mg/ 250 mL and 300 mg/ 100 mL) infused over 1 hour were used during the study time period. Adverse infusion site reactions were qualitatively and quantitatively assessed in the medical record using an infiltration and phlebitis grading system used at our institution. The Naranjo Nomogram for Adverse Drug Reaction Assessment was used to assess calcium chlorides potential impact on all moderate to severe line site reactions.

**Results:** A total of 222 patients, encompassing 224 inpatient admissions were included in the retrospective analysis. The mean age of the cohort was 61.65 8.49 years, with 114 (51.4) patients being of female gender. A total of 333 doses were administered peripherally, with 160 of the 300 mg and 173 of the 600 mg doses given. Four patients (1.8%) experienced a moderate to severe infusion site reaction, with three due to phlebitis and one due to infiltration. The Naranjo Nomogram for Adverse Drug Reaction Assessment classified all 4 patient reactions to have a possible link to calcium chloride administration.

**Conclusion:** Peripheral administration of compounded calcium chloride admixtures in 5% dextrose is associated with a low incidence of IV infusion site reactions and can be considered as an alternative in the event of a shortage of calcium gluconate.

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**Category:** I.V. Therapy / Infusion Devices

**Title:** Improving smart infusion pump performance for pediatric patients in a hospital within a hospital model.

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**Purpose:** Smart pumps improve IV therapy safety by decreasing variability in infusion parameters such as dose, concentration and infusion time. The software can also increase accountability in infusion management. Alert fatigue remains an important consideration in maximizing smart pump use in health systems. We assessed the frequency and types of alerts in pediatric patients before and after an intervention intended to better align our smart pump database with our clinical practices. Our multi-hospital system (25 hospitals, 3900 beds, 175 pediatric beds) replaced standard IV pumps with smart pumps containing dose error reduction software, and near real time reporting capabilities. Pump database rules for adults and children were originally established with the setting of care as the first decision point in setting up an infusion. For pediatric patients, division between PICU and Pediatrics organized the drug lists based on higher levels of patient acuity and monitoring. Problems with this approach surfaced quickly. For hospitals that did not have a PICU, the location labels did not fit the setting of care for every pediatric patient. High acuity medications were not intuitively available in the operating room, the emergency department, specialty ICUs(burn or trauma), and outpatient sedation area. Each drug, in each care setting, required multiple entries to accommodate all ages and sizes of children. Choosing the wrong entry in the devices meant that the product dispensed did not match the smart pump infusion rules. Since patient weight dictates dose, concentration, dose volume, and container more predictably than location, we re-organized our pediatric pump database using weight as the first drug therapy decision.

**Methods:** We comprehensively reassessed all pump database rules for pediatric patients. The database is divided into two groups, for patients OVER 40 kg, and 40 kg and UNDER. Rules were built to guide IV therapy based on patient weight using the computerized prescriber order entry (CPOE) software entries, dosing guidelines reflected in standard pediatric tertiary references, and good IV therapy practices. We also made formulary adjustments, changes in vancomycin and metronidazole dosing, and provided the ability to round a desired dose by 10% without an alarm. An 8 slide, 5 minute lesson was developed for live in-service education, and for the systems education division to place on the on the education portal. The updated database was loaded into the devices in early October 2011. Alert counts and clinician responses to alerts were evaluated using routine management reports generated by the software each month. We controlled for seasonal changes in inpatient pediatrics by comparing the same November to April

time period. November 2010 to April 2011 represents study period 1 (setting of care) and November 2011 to April 2012 is study period 2 (patient weight).

**Results:** We observed an 18% decrease in the total number of alerts from period 1 to period 2. The number of alerts resulting in a reprogrammed infusion increased from 271 to 406. The number of alerts overridden by the clinician decreased from 7404 to 5545. Canceled infusions increased. Infusions given outside the pump database rules did not change.

**Conclusion:** Ideally, a pump alert would be interpreted by the clinician as requiring a change to the pump programming. This would be reflected in reprogrammed or canceled infusions, which both increased using the new rules. Nuisance alarms are likely to be overridden. Overrides decreased using the new rules. Future priorities will focus on the top drugs involved in alerts.

**Category:** Infectious Diseases

**Title:** Review of the impact of standardized vancomycin dosing algorithm at multiple facilities within a healthcare system

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**Purpose:** Vancomycin dosing is very common for pharmacists. Applying pharmacokinetic principles and calculating initial and maintenance doses for vancomycin is imperative for improved clinical outcomes. Our goal for dosing vancomycin is to provide optimal therapy while avoiding toxicity by ensuring the appropriate dose is administered to patients. This study evaluated the impact of the implementation of a guideline-based dosing algorithm on mean first trough level with severe infections whose trough level target was 15 to 20 mcg/ml. Because nephrotoxicity is more likely with aggressive dosing of vancomycin, this characteristic was also evaluated in our patient population.

**Methods:** After IRB approval, a retrospective multi-center analysis was conducted on 109 patients from 6 facilities who received vancomycin. Inclusion criteria were patients who had a diagnosis of pneumonia, bacteremia, osteomyelitis, meningitis, sepsis, or endocarditis. A goal trough level of 15 to 20 mcg/ml was desired in all patients. Dose, frequency, mean first trough level, percentage of patients that achieved a trough level of 15 to 20 mcg/ml, and nephrotoxicity were evaluated. Nephrotoxicity was defined as a minimum of two consecutive documented increases in serum creatinine concentrations (defined as an increase of 0.5 mg/dL or a  $\geq 50\%$  increase from baseline, whichever is greater) after several days of vancomycin therapy per the therapeutic monitoring of vancomycin in adult patients consensus review of American Society of Health-System Pharmacists, Infectious Diseases Society of America, and the Society of Infectious Diseases Pharmacists. In patients who experienced nephrotoxicity, concomitant nephrotoxic medications were reviewed.

**Results:** For the 109 patients evaluated average weight was 81.4 kg and 4.6 % were receiving dialysis. The patients evaluated consisted of 49.5% male. Patients had a diagnosis of 22% bacteremia, 50.5 % pneumonia, 11.9 % osteomyelitis, 0.9% meningitis, 14.7 % sepsis, and 2.8% endocarditis. A few patients included in this study had a diagnosis of more than one of these conditions. The mean serum creatinine and creatinine clearance was 1.45 (+/- 1.6) and 66.6 ml/min (+/- 37.8) respectively. The mean dose was 1189 mg (+/- 344) with dosing frequencies of 8.4 % q8 hours, 55.1 % q12 hours, 3.7% q18 hours, 22.4% q24 hours, 3.7% q36 hours, and 6.5% q48 hours. A loading dose of 25-30 mg/kg was given in 62.4% of patients with a mean first trough level of 13.8 mg/dL (+/- 7.1). The percentage of patients who achieved a trough level of

15 to 20 mcg/ml was 54.8% with 3.43 (+/- 2.76) days to goal. Nephrotoxicity was observed in 16.5% of patients. Concomitant nephrotoxic medications consisted of 6.5 % NSAIDs, 20.4% ACEI, 3.7% ARBs, 0.9% Cyclosporine, 40.7% loop diuretics, 4.6% thiazides, 5.6% aminoglycosides, 0.9% amphotericin B, and 7.4% radiocontrast dye.

**Conclusion:** The analysis of the data showed aggressive target ranges of trough levels of 15 to 20 mcg/ml may place patients at an increased risk for nephrotoxicity. Pharmacists dosing vancomycin should be aware of other nephrotoxic medications that the patient may be taking in addition to vancomycin. Monitoring of serum creatinine, concomitant nephrotoxic agents, and trough levels should be performed by the pharmacist when dosing vancomycin. Mean first trough level may have been in our goal range if a greater percentage of patients had received a loading dose of vancomycin.

**Category:** Infectious Diseases

**Title:** Impact of an antimicrobial stewardship program in a community hospital

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**Purpose:** Implementation of an antimicrobial stewardship program has become associated with a reduced cost of antimicrobial spending and improved antimicrobial use. However, most successful programs in the literature are from academic centers. There is a lack of antimicrobial stewardship data in community facilities.

**Methods:** A retrospective analysis was conducted to evaluate the antibiotic spend from 2010 to 2011. The program at our facility has implemented extended dosing of piperacillin/tazobactam, pharmacodynamic dosing of meropenem, and a clinical note for communication with physicians on appropriate antimicrobial use. The piperacillin/tazobactam extended dosing was implemented on January 18th, 2011 and the pharmacodynamic dosing of meropenem was implemented on March 1st 2011. For patients with a creatinine clearance (CrCL) >20 ml/min or continuous veno-venous hemofiltration (CVVH) the dose of piperacillin/tazobactam was 3.375 grams every 8 hours over 4 hours and for patients with a CrCl ≤20 ml/min, peritoneal or hemodialysis the dose of piperacillin/tazobactam was 3.375 grams every 12 hours over 4 hours. For patients with a CrCL (ml/min) greater than or equal to 50, 26-49, 10-25, or <10 the dose of meropenem is 500 mg every 6 hours (excluding meningitis patients), 500 mg every 8 hours, 500 mg every 12 hours, 500 mg every 24 hours respectively over 30 minutes. Antimicrobial interventions were monitored from March to December 2011. Communication notes were left for physicians when unable to be reached by telephone.

**Results:** Antibiotic spend prior to the antimicrobial stewardship program was \$1,334,142 (\$14.46 for adjusted patient day (APD)) for 2010 and after implementation antibiotic spend was \$1,058,542 (\$11.22 APD) for 2011. For the piperacillin/tazobactam, 2010 spend was \$269,185 (\$2.92 APD) and for 2011 it was \$55,103 (\$0.58 APD). The carbapenem spend for 2010 and 2011 was \$160,546 (\$1.74 APD) and \$97,013 (\$1.03 APD) respectively. The number of interventions for positive culture/no antibiotic, evidence of infection, need additional coverage, culture & sensitivity does not support, treatment failure, broaden therapy, de-escalation, inappropriate for condition, course is complete, and antibiotic not indicated for March through December of 2011 were 136, 4, 23, 110, 1, 16, 93, 8, 10, and 8 respectively. Physician acceptance rate for all documented recommendations for March, April, May, June, July, August,

September, October, November, and December 2011 was 99%, 100%, 97%, 98%, 98%, 93%, 96%, 93%, 95%, and 94% respectively.

**Conclusion:** The analysis of the data shows an antimicrobial stewardship program in a community hospital benefits the facility financially and can be well received by the medical staff while improving patient care. The facility reduced its antimicrobial spend in one year after implementation by 22.4%. Pharmacists improved patient care by monitoring cultures and making recommendations to the attending physicians by either telephone or an antimicrobial stewardship program prospective audit & clinical note. The pharmacists recommendations to the physicians were well received with a 93% or higher acceptance rate. As the program continues to grow there will be additional opportunities to improve patient care.

**Category:** Infectious Diseases

**Title:** Economic impact of clinical response at day 3 of initial antimicrobial treatment in hospitalized patients with acute bacterial skin and skin structure infections: a chart review study within a US healthcare system

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**Purpose:** Recently issued FDA guidance for Acute Bacterial Skin and Skin Structure Infections (ABSSSI) recommends a responder variable for clinical outcome at 48 to 72 hours as the primary endpoint; however, the economic outcome of the responder variable at 48 to 72 hours has not been well-documented. The purpose of this study was to evaluate cost differences among ABSSSI patients achieving or not achieving an FDA-defined clinical response at Day 3 of initial antibiotic therapy.

**Methods:** The institutional review board approved this retrospective evaluation of medical charts and electronic claims data. The data were used to identify adult patients with a primary diagnosis of ABSSSI (redness, edema, febrile, lesion 75 cm squared) hospitalized between 7/1/2010 and 12/31/2011. Patients were stratified into 3 cohorts: all ABSSSI, cellulitis/erysipelas and abscess (CEA), wound infection (WI). Total cost of care (defined as charges) was assessed for patients who achieved (responders) and did not achieve (non-responders) clinical response as per FDA criteria (i.e., cessation of lesion spread, absence of fever) within 72 hours of initial antibiotic therapy.

**Results:** A total of 404 ABSSSI, CEA (N=297), and WI (N=107) patients were in the analysis. The initial antibiotic Day 3 response rate was 61%, 68% and 48% for ABSSSI, CEA, and WI, respectively. The mean (median) hospital length of stay in days for non-responders and responders in all ABSSSI, CEA and WI cohorts was 15.8 (14) vs. 10.4 (10), 14.1 (12) vs. 10.2 (10), and 18.7 (16) vs. 10.8 (10), respectively. The mean total cost of care for responders vs. non-responders was \$92,585 vs. \$150,203, \$88,724 vs. \$125,161, and \$109,909 vs. \$191,342, for all ABSSSI, CEA, and WI patients, respectively.

**Conclusion:** Approximately 61% of US hospitalized ABSSSI patients achieved clinical response at Day 3 of initial antimicrobial therapy. The total cost of care of non-responders was over 1.5 times that of those who achieved clinical response at Day 3 of initial therapy.

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**Category:** Infectious Diseases

**Title:** Hepatitis C VHA task force: How to deliver great care anywhere

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**Purpose:** To describe the VA VISN 12 task force model employed for optimizing the management of patients with genotype 1 hepatitis C virus (HCV). This multi-disciplinary model aimed to align its 7 unique VA facilities to provide complex evidence based treatments utilizing pegylated interferon and ribavirin combination with a protease inhibitor (boceprevir or telaprevir). Potential laboratory and patient needs were identified, a standardized approach to side effect management and adverse drug reaction reporting was discussed and unique and universal problems were solved for this multi-disciplinary group of providers.

**Methods:** A hepatitis C experienced clinical pharmacist was identified and tasked to bring clinicians together from each its seven VA facilities that comprise VISN 12. The group recognized a potential of 3400 patients may potentially meeting criteria for new therapies containing protease inhibitors. Each facility identified one or more provider to participate in teleconferences discussing issues pertaining to antiviral therapy, as well as individual clinic set-up and support. Initially, the teleconferences were conducted every two weeks for 50-90 minutes and an agenda and minutes were created to keep track of discussions and action plans and to allow communication for providers unable to join the conference call(s). Barriers to optimizing care were identified: 1. HCV viral load of < 43 iu/ML was not optimal and the facilities needed a HCV RNA lower limit of < 10-15 IU/ml in order to provide response guided therapy. 2. The turn around time for HCV RNA results was suboptimal at more than 2 weeks for some facilities. (Achieving new limit of detection and quicker turn around time would allow providers to discontinue therapy if the patient was not responding and resistance suspected). 3. Manpower issues included lack of a dedicated clinic to see patients, lack of full time provider availability, and lack of specialty clinic to manage side effects such as psychiatry, dermatology, ophthalmology, infusion clinic and in one case, lack of an on-site liver specialist to provide care. 4. Variable knowledgebase needs for new clinicians assigned to the HCV clinics including clinical tools to aid in monitoring as well as guidance about potential drug-drug interactions. Other goals identified by the task force include Improve and standardize reporting of significant adverse drug reactions. To follow patients on treatment to see if side effects and response to therapy were in keeping with published studies. As patients embarked on therapy, sharing experience and results with the group became important. Conference calls were scheduled on a monthly basis or on as needed basis. Site specific issues came up and were managed one on one

with the task force manager whose role was to act as a conduit for ideas and information as well as visit with clinicians at their facility to address unique issues.

**Results:** The Task force met through conference calls every two weeks from September 2011 to October 2011, then at one month intervals until all the barriers were resolved and the main objectives were met. By the end of January 2012, all the facilities were standardized. The task force manager prepared reports to review side effects, use of supportive medications, and requested for task force members to share their experiences with clinic work flow, barrier resolution, and any other issues or tips. With the support of VISN executives, the task force enabled a universal improvement in Hepatitis C Virus (HCV) RNA testing. On January 17, 2012, after two month of robust quality assurance testing, the molecular laboratory was reporting HCV RNA results with a lower limit of < 10 iu/ml. The turnaround time for lab results improved to 3-12 days allowing providers time to make decisions concerning continuation of therapy as appropriate. Manpower needs were discussed and experienced providers shared realistic goals about allocating time to evaluate patients, provide injection teaching and conduct follow-up visit. Recommendations to create affiliations with specialty clinics in psychiatry, dermatology, hematology for infusion clinics were discussed and encouraged for new providers to set up their clinics efficiently. Knowledge based tools (VA hepatitis patient and provider website, ask the expert, criteria for specific drug use, drug drug interaction tool) were shared with providers to utilize when caring for patients. These tools are standardized; evidence based, and are updated nationally to maximize patient care. Electronic consults for drug use evaluation (such as boceprevir criteria for use), allowed providers to systematically identify patients meeting treatment candidacy. A consensus about adverse drug reaction reporting was reached by the group after soliciting an expert in this field to provide guidance. The group identified realistic and achievable parameters to help standardize reporting. A review of reported adverse drug reactions in fiscal year quarter 1 and quarter 2 indicated VISN 12 was one of the highest reporting VISNs in the country with 9 events reported in the first fiscal quarter which increased to 41 events for the second quarter. Providers were given opportunity to share and discuss concerns and experiences as well as innovative solutions employed at their facilities providing other sites with ideas to consider. These included agreements between liver clinic and the hospital infusion clinic to provide blood transfusions instead of admitting patients to the hospital. On occasions where there was lack of consensus about a problem/issue, the task force manager would query experts outside the VISN to offer data supporting decisions or offering expert opinions involving difficult to treat patients. A review of the taskforce history and success can be likened to a Ferris Wheel Model. (see poster for visual) . The foundation of the structure is provided by national groups and experts. The momentum and support of the Ferris wheel is provided by the VISN executives and task force manager. Each facility is represented by a "pod" on the Ferris wheel.

**Conclusion:** A robust multi-disciplinary task force can be created to provide complex care to patients with hepatitis C embarking on therapy with protease inhibitor containing regimens. A Ferris wheel model describes how care can be standardized with respect to laboratory monitoring, side effect reporting and improved access to treatment tools. Comfort with disease state management is enhanced when subject matter experts are available to lend support. Furthermore, sharing experiences provides clinicians with a much larger set of information to draw new ideas and solve problems. Clinical Pharmacy subject experts are excellent conduits

bringing clinicians and patients together to provide the best care anywhere irrespective of clinic makeup, support or structure.

**Category:** Infectious Diseases

**Title:** Active pharmacy involvement in the antimicrobial review subcommittee to improve antimicrobial utilization in a community hospital

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**Purpose:** Emerging antimicrobial resistance is a significant healthcare issue that impacts healthcare quality and patient safety. The decrease in the development and approval of new antimicrobial agents has led many hospitals to develop antimicrobial management strategies to improve clinical outcomes and reduce the spread of resistant organisms. Over five years ago, in our full service, 221-bed, community hospital, an Antimicrobial Review Subcommittee (ARS) was developed as a subcommittee of the Pharmacy and Therapeutics Committee to improve antimicrobial utilization and optimize clinical outcomes. The ARS is comprised of infectious disease physicians, pharmacists, a microbiologist, and an infection control and prevention nurse. The committee meets quarterly to identify and discuss issues relating to antibiotic use and to propose ideas to improve the utilization process and optimize clinical outcomes. The ARS also works closely with the antimicrobial stewardship program to further its success because many of their objectives overlap. The stewardship program identifies antibiotic usage trends and collaborates with ARS to plan and initiate changes for improvement. On an annual basis, a yearly published antibiogram is reviewed for pathogen sensitivity and resistance trends and prompts education, policy, and guideline changes. Pharmacists take an active role in the ARS by sharing ideas and implementing the proposed ideas for improvement discussed at the meetings, as well as organizing the meetings and recording the meeting minutes. We describe how active pharmacist involvement in the ARS has led to implementation of multiple strategies to improve antimicrobial drug utilization.

**Methods:** The ARS identified multiple issues relating to antimicrobial use and proposed ideas to improve their utilization. The identified issues are: (1) lack of a clear indication for antibiotic treatment, (2) inappropriate vancomycin dosing, trough monitoring, and methicillin-resistant *Staphylococcus aureus* (MRSA) screening, and (3) piperacillin/tazobactam (pip/tazo) overuse. Pharmacists on the committee worked closely with information systems and informatics pharmacists to implement the proposed strategies by coming up with ideas for specific entries to be created in the computerized physician order management (CPOM) system and following-up to make sure that the entries were built. (1) To facilitate appropriate antibiotic use, dosing, and monitoring, ARS recommended that all antibiotic orders should have a clinical indication specified by the ordering physician. A hard-stop for ordering antibiotics was created in the CPOM system requiring a selection of an indication from a drop-down menu. (2) The ARS identified that frequent under-dosing of initial vancomycin treatment occurred due to vancomycin doses not being ordered based on patient weight. Weight-based dosing order-strings were built in CPOM prompting physicians to enter doses based on 15 mg/kg or 20 mg/kg using patient weight while pre-determined vancomycin doses were eliminated. Vancomycin troughs were being monitored prior to achievement of steady-state, often before the third dose. The

default CPOM entry of ordering a vancomycin trough level prior to the third dose was eliminated and an entry with the primary selection of a trough level prior to the fourth dose was built in CPOM with the option to order a trough prior to an alternate dose. MRSA screening tests were not being routinely ordered for patients on vancomycin. A reflex MRSA screening test order was built in CPOM to be ordered automatically when vancomycin is ordered. (3) The ARS identified that overuse of pip/tazo was an issue in our hospital. A hard-stop administration criteria was developed alerting physicians that the main difference between pip/tazo and ampicillin/sulbactam is the coverage of multi-drug resistant organisms. The administration criteria requires the physician to answer "yes," "no," or "unknown" as to whether the patient has a high suspicion of multi-drug resistant organisms (e.g., *Pseudomonas aeruginosa*).

**Results:** (1) A clinical indication requirement was created for 55 antimicrobials and implemented in April 2012. (2) A total of 2707 doses of vancomycin were dispensed over a twelve-month period (May 2011-April 2012). During this time period, 676 orders entered in CPOM for vancomycin were processed by the pharmacy. From the 676 orders, 160 vancomycin orders were entered in CPOM using weight-based dosing (24%). These values do not distinguish if multiple orders for dose changes were entered on a single patient. Not captured in this total number of orders are those orders that were entered in CPOM but had to be cancelled and re-entered by a pharmacist to accommodate dispensing differences (e.g., medication from automated dispensing cabinet vs. intravenous medication mixed in the IV room). From May 2011 through April 2012, a total of 966 vancomycin trough levels were ordered. Vancomycin trough levels prior to the fourth dose were ordered for 531 troughs (55%) and trough levels prior to an alternate dose were ordered for 435 troughs (45%). These values do not distinguish if multiple trough levels were ordered on the same patient during an extended monitoring period. (3) A total of 1037 doses of pip/tazo were dispensed over a twelve-month period (May 2011-April 2012). During this time period, a total of 836 pip/tazo orders were entered in CPOM. This excludes orders from the emergency department which does not use CPOM. Out of the total number of orders entered in CPOM, "yes" was answered for 497 orders (59%), "no" for 63 orders (8%), and "unknown" for 276 orders (33%).

**Conclusion:** Ensuring appropriate antibiotic use is important to improving patient outcomes. Active pharmacy involvement in the Antimicrobial Review Subcommittee has led to the development and implementation of multiple strategies for facilitating appropriate antimicrobial use, dosing, and monitoring.

**Category:** Infectious Diseases

**Title:** Evaluation of fidaxomicin use for Clostridium difficile Infection in an 881-bed community-teaching hospital

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**Purpose:** Clostridium difficile Infection (CDI) continues to plague patients within the healthcare setting and leads to increased healthcare cost. It is paramount that judicious and appropriate pharmacotherapy is implemented for patients with CDI as to prevent future patient transmission and unnecessary hospital admissions thereby risking poor patient outcomes and reduced reimbursement. The purpose of this analysis was to determine clinical outcomes of fidaxomicin for the treatment of CDI and corresponding clinical cure rates, recurrences, and hospital readmission rates.

**Methods:** This institutional review board approved retrospective analysis incorporated patients who were prescribed fidaxomicin for the treatment of CDI between August 2011 and March 2012. Patients > 18 years old prescribed fidaxomicin with > 3 loose stools 24 hours prior to therapy with a diagnosis of CDI were included. Signs and symptoms of CDI or a positive polymerase chain reaction (PCR) culture did not determine if a patient would be included in the evaluation. Patients were excluded if they received 1 day of fidaxomicin therapy. Clinical outcomes were defined as positive, which included both complete cure and clinical improvement; negative, which included continuation of signs and symptoms after full course of therapy, clinical deterioration or death related to infection occurred; indeterminate, if outcomes could not be identified due to outlying circumstances. Clinical cure was defined as resolution of all signs and symptoms of CDI; improvement was defined as a measurable positive change in patient outcome with partial resolution of signs and symptoms of infection. Clinical deterioration was defined as a continuation of the infection-related signs and symptoms. Death was documented only if related to the infectious process under evaluation. The final disposition of all patients 30 days after primary hospital discharge was also assessed. Medical records of all included patients were followed during the patients hospital stay, as well as if the patient was readmitted within 30 days of initial hospital discharge. Patient information after discharge was also assessed to evaluate the studys end points and outcomes. Data collected included patient demographics, dose and duration of fidaxomicin therapy, microbiology reports, duration of signs and symptoms of infection, other antibacterials given for previous and current CDI infections, other antimicrobials given during current hospitalization, adverse drug reactions. Pseudomembranes were identified on those patients in whom PCR testing was not performed.

**Results:** Seventeen of the twenty-two patients (77%) experienced clinical cure after receiving fidaxomicin, while 5 of the 22 patients (23%) presented with a 30-day recurrence. Of the total 22 patients, 15 (68%) presented with a history of CDI. Eleven of the fifteen (73%) CDI history patients experienced clinical cure after receiving fidaxomicin, while 5 of the 15 patients (33%) presented with a 30-day recurrence. The hospital readmissions are as follows: 30 days (3/22 or 14%); 60 days (8/22 or 36%); 90 days (9/22 or 41%). For the 15 patients with CDI history, the readmissions are as follows: 30 days (2/15 or 13%); 60 days (6/15 or 40%); and 90 days (8/15 or 53%). Concomitant system antibiotics were administered in 14 of 22 patients (64%). PCR or examination findings was documented in 19 (89%) of patients with 1 patients PCR test showing the presence of the binary toxin for the BI / NAP1 / 027 strain. An average of 5.5 days of fidaxomicin therapy was administered while inpatient. One patient required a colectomy.

**Conclusion:** In this evaluation of fidaxamicin for the treatment of CDI, the majority of patients achieved clinical cure. Readmission rates were similar to previously published studies demonstrating a potential reduction in 30-day readmission rates with fidaxamicin. Although larger studies should be performed before fidaxamicin is routinely used for the treatment of CDI recurrence, our experience suggests that this antimicrobial agent may be a potential option to achieve clinical cure and decrease 30-day readmission rates and associated costs.

**Category:** Infectious Diseases

**Title:** Antimicrobial order sheet (AOS) data completion by physicians: impact of a strict enforcement policy

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**Purpose:** Antimicrobial order sheets (AOS) are a useful tool for antimicrobial stewardship programs (ASP). AOS have been utilized at Riyadh Military Hospital (RMH) for more than 10 years. Effectiveness of AOS's depend on physicians and pharmacists adherence with completely and accurately documenting required information, but actual practice at RMH was not known. We sought to measure the completeness of data provided by physicians on AOS before and after implementation of new strict enforcement policy at RMH.

**Methods:** We conducted a retrospective audit assessing completion of required information for AOS forms pre and post-enforcement of a strict AOS policy at RMH February 2012. The sample included all AOS with at least a medical record number filled in from January 2012 (pre-enforcement group) and 2nd week April 2012 (post-enforcement). Data was collected and entered manually into an Excel worksheet and evaluated using simple descriptive statistics. Primary outcomes included completeness and legibility of data within demographics and clinical data sections of the AOS pre and post-enforcement. Secondary outcomes included characterization of prescribing patterns (including indication) and agents used.

**Results:** A total of 472 AOS were analyzed in the in the pre-enforcement period compared to 123 AOS from post- enforcement period. Illegibility of first and last name was common and did not change (22-28% pre vs 25-27% post-enforcement). Completion of demographic information pre-enforcement was 48% for Age and 60% for Sex, which improved to 85% and 96% respectively post-enforcement. Completion of clinical data improved for weight (37% pre vs 96% post enforcement), drug allergy (3% pre vs 97% post enforcement) and serum creatinine (3% pre vs 93% post). Of the 472 AOS, 195 (41%) were prescribed in the Accident and Emergency Department, 71 (15%) Medicine, 69 (15%) Surgery, 66 (14%) Pediatrics, and 56 (12%) missing or illegible. Of the 579 antibiotics orders in the pre-enforcement group that included the indication, empirical therapy was most common (396 = 68%) followed by documented infection (123 = 21%) and prophylaxis (60 = 10%). The most common antibiotics prescribed were ceftriaxone (116 = 20%), piperacillin/tazobactam (84 = 15%) and azithromycin (67 = 12%).

**Conclusion:** Implementation of a strict enforcement policy improved compliance with physician completion of demographic and clinical data within an AOS, but did not improve legibility.

**3-141**

**Category:** Infectious Diseases

**Title:** Parental nutrition: correlation between lipid emulsion administration and incidence of candidemia

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**Purpose:** To evaluate whether changing the frequency of intravenous lipid emulsion (IVLE) infusions from bi-weekly to daily during total parental nutrition (TPN) decrease the incidence of candidemia.

**Methods:** Due to an IVLE shortage, patients received biweekly IVLE infusions instead of daily IVLE. This alternative schedule occurred from July 7th to December 8th 2010. This retrospective chart analysis reviewed all TPN patients who developed candidemia during and after the IVLE lipid shortage. Patients who received antifungal therapy or prophylaxis at the time of TPN or whose admitting diagnosis was candidemia were excluded. Information collected included patient demographics, TPN indication and duration, Candida species isolated, and additional risk factors for infection.

**Results:** Candidemia occurred in 3.4% IVLE biweekly vs. 3.8% IVLE daily groups [ $p=0.61$ , OR 1.008 (0.39-3.39)]. Administration of daily IVLE had a fungemia rate of 4.2/1000 TPN days vs. 2.9/1000 TPN days for biweekly IVLE [ $p=0.38$ , OR 1.4 (.48 4.8)]. Mean age was 60 for the bi-weekly IVLE vs. 59 for the daily IVLE emulsion ( $p=0.582$ ) and incidence of GI surgeries was 46.3% vs. 53.6% respectively ( $p=0.135$ ).

**Conclusion:** Administering IVLE biweekly as opposed to daily did not appear to significantly decrease the incidence of candidemia in patients receiving TPN.

3-143

**Category:** Infectious Diseases

**Title:** The effect of proton pump inhibitors versus histamine-2 receptor antagonists in the development of clostridium difficile infection and pneumonia: a retrospective review

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**Purpose:** Evidence supports an increased risk for the development of clostridium difficile (c. difficile) diarrhea as well as aspiration pneumonia in patients receiving potent acid suppression therapy. The purpose of this study was to assess the effects of proton pump inhibitors (PPI) on the development of c. difficile and pneumonia (nosocomial and up 90 days after discharge), using patients receiving histamine-2 receptor antagonists (H2RA) as the control group.

**Methods:** The institutional review board approved this retrospective chart review of patients who received at least one dose of PPI or H2RA during hospital stay. Patients were excluded if they received both PPI and H2RA, if they were admitted to the intensive care unit (ICU) or admitted from a nursing home and if they had a history of recent c. difficile infection (past 6 months). Data was collected on age, gender, length of stay, concomitant antibiotic use and development of c. difficile and/or pneumonia during hospital stay and readmission for the same up to 90 days after discharge.

**Results:** A total of 154 patients (78 PPI and 76 H2RA) were included in the study. The average age was 60 years (PPI) and 58 years (H2RA). The majority of patients in both groups were female. The average length of stay was 3.3 days in the H2RA group and 4.5 days in the PPI group. Significantly more patients were on antibiotics in the H2RA group (42 percent) as compared to the PPI group (25 percent). C. difficile developed in 6.6 percent of patients in the PPI group, compared to 3.8 percent of patients in the H2RA group, a 42 percent relative risk increase. The rates of nosocomial pneumonia and readmission for pneumonia were not significantly different between the groups, with absolute percentages for both higher in the H2RA group.

**Conclusion:** Despite the low numbers of patients in the study, an increased risk of c. difficile associated with PPI therapy was demonstrated. In light of significantly more antibiotic use in the H2RA group, this difference is likely even greater. With the increasing incidence and virulence of c. difficile, strong consideration should be given to avoiding PPI therapy in hospitalized patients without clear indications for such therapy. H2RA therapy should be given for stress ulcer prophylaxis in non-ICU patients to minimize this risk.

**Category:** Infectious Diseases

**Title:** Evaluation of vancomycin dosing in the obese population

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**Purpose:** Vancomycin has been in clinical use for nearly fifty years for the treatment of serious gram positive infections involving methicillin-resistant *Staphylococcus aureus* (MRSA). Dosage recommendations, as given by the 2009 vancomycin consensus statement, suggest initial vancomycin dosing be based on actual body weight (ABW). However, while current recommendations suggest dosing based on actual body weight, data is limited regarding dosing in obese patients. The purpose of this study was to determine if initial vancomycin dosing resulted in target serum trough concentrations in obese patients (body mass index greater than or equal to 30 and total body weight greater than or equal to 140 percent of ideal body weight).

**Methods:** The institutional review board approved this six month retrospective study from November 1, 2010 to April 30, 2011. All patients greater than or equal to 18 years of age, with a body mass index greater than or equal to 30 and total body weight greater than or equal to 140 percent of ideal body weight, who received vancomycin and had serum trough levels drawn prior to the third or fourth dose of therapy were included. Age, weight, height, serum creatinine (SCr), creatinine clearance (CrCl), medical diagnosis for use of vancomycin, and other medical diagnoses were collected for each patient. Target trough concentrations were 10 to 15 mcg per ml or 15 to 20 mcg per ml based on indication as determined by the 2009 vancomycin consensus statement. Initial vancomycin dosing was based on the recommended 15 to 20 mg per kg using actual or adjusted body weight with interval determined by renal function.

**Results:** A total of 45 patients were included in the study. Eighteen patients (40 percent) had initial serum trough concentrations in the target therapeutic range (10 to 15 or 15 to 20 mcg per ml depending on infectious disease). Twenty-three patients (51.1 percent) had initial trough concentrations that were sub-therapeutic (less than 10 mcg per ml or not within desired target trough concentration as recommended by consensus statement). Of those patients, thirteen (56.5 percent) had trough concentrations less than 10 mcg per ml and 10 patients (43.5 percent) had initial trough concentrations below the desired target trough for their disease state. Four patients (8.9 percent) had initial trough concentrations greater than 20 mcg per ml.

**Conclusion:** Initial vancomycin dosing did not achieve target serum trough concentrations in the majority of obese patients (60 percent). Some institutions have developed dosing parameters in patients who are obese and have initiated dosing based on an adjusted body weight calculation. However, documentation provided did not allow for determination of dosing based on actual or

adjusted body weight. Currently based on these results, dosing of vancomycin in the obese population is sub-optimal.

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**Category:** Infectious Diseases

**Title:** Impact of converting levofloxacin to high-dose equivalent regimen in a community teaching hospital

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**Purpose:** Antibiotic resistance is a growing concern in healthcare, particularly with fluoroquinolones where resistance to gram-negative organisms has increased substantially over the last decade. Development of resistance is attributed to several factors including over-utilization of antibiotics, unnecessary use and inappropriate dosing of these agents. To combat resistance and improve fluoroquinolone utilization at our facility we implemented a policy to convert all levofloxacin to a higher-dose regimen. This policy was approved by our institutions Pharmacy & Therapeutics and Medical Executive committees in June of 2008. The goal was to maximize the pharmacodynamic effects of the drug, improve dosing, and observe its impact on our institutions antibiogram.

**Methods:** All doses of levofloxacin were converted to the high dose equivalent based on their renal function [Estimated Creatinine Clearance (Est. CrCl) > 50ml/min doses of 500mg q24h were increased to 750mg q24h; Est. CrCl 20-49ml/min doses of 250mg q24h were converted to 750mg every 48h; Est. CrCl < 19 ml/min doses of 250mg q48h were changed to 500mg q48h. One time doses were modified to 750mg]. Microbiology results at our institution were reviewed for all inpatient E. coli isolates collected during the calendar years of 2005, 2008, and 2011. A two-sided Fishers exact test with a 95% confidence interval was used to determine differences in susceptibility rates. A Bonferroni correction was used to adjust p-values for multiple comparisons. A medication utilization review was also performed prior and post conversion to assess levofloxacin use in all inpatients.

**Results:** A significant increase in rate of resistance was seen in the 3 years pre-intervention (11.3%,  $p=0.0001$ ) as opposed to the 3 years post conversion to the high-dose regimen (4.1%,  $p=0.1376$ ). Utilization data collected in the years prior and post conversion showed a similar total number of patients treated (based on Defined Daily Dose/1000 patient days), similar patient demographics, and similar indications for use. Appropriate dosing adjustments according to estimated renal function also improved from 57.5% in 2007 to 92.6% in 2012 with conversion to the high-dose regimen.

**Conclusion:** A hospital-wide conversion of levofloxacin to a high-dose regimen was instituted in 2008 to combat fluoroquinolone resistance and to improve utilization. Despite an overall

increase in resistance post-conversion, a significant slowing of the rate was observed. Medication utilization reviews also demonstrated an improvement in correct dosing. These results suggest that a conversion of all doses of levofloxacin to a high-dose regimen may be beneficial in not only improving utilization of the drug, but may also slow resistance development in some settings.

**Category:** Infectious Diseases

**Title:** Expansion of an antimicrobial stewardship program after implementation of a pharmacist-driven positive culture review process

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**Purpose:** As the medical community continues to battle the emergence of resistant organisms, antimicrobial stewardship programs are becoming increasingly more complex. Furthermore, once culture results are known, ensuring patients receive the most targeted antimicrobials improve patient outcomes, minimizes inappropriate antimicrobial use and helps prevent antimicrobial resistance. This project was designed to quantify and categorize pharmacist interventions post-implementation of a pharmacist-driven positive culture review process.

**Methods:** An antimicrobial stewardship program was developed at Moore Regional Hospital, a 395-bed community hospital. As a key component of the program, the medical staff and pharmacy developed collaborative practice agreements allowing pharmacists to monitor and adjust antimicrobial dosing as appropriate for the indication and patients renal function. Beginning in February 2012, the antimicrobial stewardship program was expanded to include a pharmacist review of all positive cultures. In addition to their standard clinical duties, decentralized pharmacists reviewed a daily list of patients with positive cultures (preliminary and final) returned within the last 48 hours. Upon review of the culture results, the pharmacist contacted the patients physician to discuss antimicrobial options. Pharmacists documented interventions in the pharmacy information system and categorized each intervention into the following categories: change in therapy, therapy addition, therapy de-escalation, culture clinically insignificant/contaminant and recommendation rejected. Data analyzed for the study period included the total number of antibiotics dosed, the number of positive cultures reviewed and the number and category of pharmacist interventions. Post-implementation data was collected and analyzed for 3 months.

**Results:** Pharmacists dosed 2695 antibiotics during the study period. Upon reviewing a total of 738 positive cultures, pharmacists performed 85 interventions (11.5%). Changes to antimicrobial therapy based on organism identification and sensitivities (45%, n = 38) represented the most common interventions. Twenty-three (27%) interventions involved the addition of antimicrobial therapy for patients with positive cultures not currently receiving antimicrobials. Pharmacists de-escalated therapy in nine circumstances. After consulting with the treating physician, twelve positive cultures were deemed clinically insignificant. Only three interventions (4%) were rejected by the patients physician.

**Conclusion:** Reviewing positive culture results allowed pharmacists to help ensure appropriate antimicrobial use within the health-system. The vast majority of recommendations were accepted and reflect significant modifications and improvements to the patients antimicrobial therapy.

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**Category:** Infectious Diseases

**Title:** Clinical and Economic Evaluation of Tenofovir/Emtricitabine for Pre-Exposure Prophylaxis of HIV in Men Who Have Sex with Men with Implications for the MassHealth Perspective

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**Purpose:** The risk for acquiring an HIV infection is between 11 to 25 times greater in the men who have sex with men (MSM) population. Although they are estimated to be 2% of the general population, this demographic accounts for 61% of new infections annually. Research has shown that the pre-exposure prophylaxis (PrEP) with once daily Truvada can reduce the number of infections. This budget impact analysis evaluates the financial implications of PrEP with Truvada in the MSM population from the perspective of the MassHealth budget holder.

**Methods:** In order to evaluate the clinical relevance of PrEP with Truvada, a literature search was performed on PubMed/Medline (2004 to April 2012) using the search terms Truvada, emtricitabine, tenofovir, pre-exposure prophylaxis, and men who have sex with men. This resulted in one article that was a randomized control trial. To evaluate the economic impact of PrEP with Truvada, a literature search was performed on Pubmed/Medline (2004 to April 2012) using the search terms Truvada, emtricitabine, pre-exposure prophylaxis, men who have sex with men, and cost effectiveness. This search yielded two articles. A budget impact analysis exploring the economic implications of providing PrEP with Truvada to the MSM population was conducted from the perspective of the MassHealth budget holder. Scenarios being compared included the strategy of PrEP with Truvada to the current standard of care of not providing PrEP and treating HIV once a person gets infected. This budget impact analysis was conducted during the year 2011 and has a one-year duration. The cost of providing PrEP with Truvada was calculated from retail pharmacy dispensing fees and the average wholesale price of Truvada, which was discounted to reflect rebates provided to Medicaid programs. The yearly cost of treating a person with HIV was adapted from the amount of money MassHealth spent on treatment per HIV patient in 2007. All prices were inflated using medical consumer price index rates provided by the US Bureau of Labor and Statistics to reflect 2011 cost data. The population was limited to the MSM population aged 18 or older in Boston, Massachusetts. Subgroup analysis was performed on the black non-Hispanic MSM population aged 18 or older in Boston and sensitivity analyses were performed on scenarios including a generic Truvada becoming available and varying degrees of PrEP effectiveness.

**Results:** The cost to treat an estimated 79 new infections at \$24,583 per infection over a 1-year time period would be \$1,942,057. In comparison, providing prophylaxis to an estimated Boston MSM population aged 18 or older of 18,973 at a cost of \$10,482 per person would cost \$198,974,986. Assuming a 44% reduction in the number of transmissions, the total cost to provide prophylaxis to the MSM population, including the cost of treating those that acquired HIV despite PrEP, is \$199,956,638. The costs associated with providing PrEP are \$198,014,581 more than the costs associated with treating new infections upon diagnosis. Sensitivity analysis was conducted varying the cost of Truvada. In a hypothetical situation where a generic version of Truvada becomes available at an annual cost of \$144, the costs associated with providing PrEP would be \$1,871,707 more than the cost of treating new HIV infections upon diagnosis. Other sensitivity analysis were conducted on 15%, 63%, and 100% effectiveness of PrEP, with each analysis resulting in significantly higher costs associated with providing PrEP than treating new infections upon diagnosis. The cost to provide prophylaxis to the smaller Boston, non-Hispanic black MSM population in Boston is \$8,752,470. When compared to the cost to treat established infections in this population, the difference was \$8,629,555 in favor of treating only established infections.

**Conclusion:** At current market value, the cost of PrEP with Truvada cannot be justified to the MassHealth budget holder. Truvada has proven to be an efficacious option for PrEP, and there are currently no other medications on the market indicated for PrEP. However, current treatment costs do not make it an attractive intervention for MassHealth. Strategies such as decreasing cost of the drug and increasing efficacy would make the intervention more plausible to budget holders. Subsequent work should be focused on identifying specific populations and geographical locations that are at the highest risk of HIV transmission. This would allow for a more cost-effective, selective use of PrEP only in those at the highest risk of HIV transmission.

**Category:** Infectious Diseases

**Title:** Assessing the adherence to the idsa guidelines for empiric treatment of community acquired pneumonia in intensive care unit patients at three Lebanese university hospitals

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**Purpose:** Misguided approaches when dealing with Community Acquired Pneumonia (CAP) treatment has led to the emergence of a major conflict of antibiotics resistance. No recent study has evaluated the applicability of the IDSA guidelines in intensive care units (ICU) patients admitted to various Lebanese hospitals. Our objective is to assess the physician compliance with IDSA guidelines for the empiric treatment of CAP in ICU patients at three Lebanese university hospitals.

**Methods:** We conducted a multicenter retrospective trial for patients admitted to the ICU. We included all patients with 18 years or older with community acquired pneumonia and admitted to ICU and excluded patients with malignancies, Human immunodeficiency virus (HIV), acquired immunodeficiency syndrome (AIDS), Sepsis Tuberculosis (TB) , Crcl< 30 ml/min or used corticosteroid for > 30 days. For the duration of one year we screened 690 patients, 79 patients met the inclusion criteria and 611 were excluded. The primary endpoint is to assess adherence of the Lebanese hospitals to the IDSA guidelines with respect to the use of antibiotics in the empiric therapy of CAP in adult patients admitted to the ICU. The secondary outcome is to assess the use of antibiotics according to culture results, and the need for ICU admission in patients admitted to the ICU.

**Results:** Adherence to IDSA guidelines with respect to empiric antibiotic use in treatment of CAP was found in 24 patients out of 79 (30%).Empiric antibiotic therapy was given in 54 patients (68%) with no cultures taken, 22 patients with negative cultures (28%) & 3 patients (4%) with positive cultures. 36 ICU patients (46 %) fulfill the requirements for the ICU admission according to the guidelines admission criterias (CURB65) versus 43 patients (54 %) are at the ICU and didnt fulfill the guidelines admission criterias (CURB65) . Adherence to IDSA guidelines (according to antibiotics used, culture results & need for ICU admission) didnt affect significantly the overall patient response (P= 0.209).

**Conclusion:** Adherence to IDSA guidelines in terms of use of antibiotics was not met. The use of antibiotics was not significantly dependent on culture results; most of the times, culture was taken after therapy is started. The need for clinical pharmacist at the ICU is important to prevent the misuse of the empiric antibiotic therapy. According to CURB65 criteria of IDSA guidelines

for determining the need for ICU admission, most of the patients didnt really need ICU admission.

**Category:** Infectious Diseases

**Title:** Evaluation of pharmacist role on antimicrobial surgical prophylaxis in a lebanese hospital

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**Purpose:** During surgical procedures, prophylactic antibiotics should be implemented to decrease bacterial proliferation and limit postoperative complications as infections. Prophylactic antibiotics should be given one hour prior to the surgery and discontinued within twenty four hours from the end of surgery. The purpose of the study was to evaluate the practice of antibiotic surgical prophylaxis in a Lebanese hospital after the chief pharmacist intervention.

**Methods:** A retrospective chart review was conducted in a lebanese hospital from August 2010 till February 2011. The data collected included patient age, duration of the surgery, antibiotic time of administration prior to surgery and discontinuation after surgery. Patients above eighteen years of age and admitted for clean or clean contaminated surgeries were included. Patients were excluded if they were not prescribed antibiotic, treated with any antibiotic prior to surgery, or had contaminated surgery. The study was approved by the Institutional Review Board (IRB). Patient identifiers included only patient ID number and date of birth. These patient identifiers were used only to identify eligible patients and removed from all study data as soon as data collection was completed to assure that patient privacy was maintained. The primary outcome measure was the percentage of antibiotics administered within one hour maximum prior to surgery and the duration of prophylaxis.

**Results:** There were 340 patients who met the inclusion criteria. The percentage of antibiotics administered within sixty minutes maximum prior to the surgery is 82.35 percent (280 patients out of 340). The percentage of the administered antibiotics prior to surgery which was stopped within twenty four hours after the end of surgery is 70 percent (238 patients out of 340). Data related to the time of antibiotic administration and discontinuation prior to August 2011 was not available since antibiotic selection, administration, and discontinuation was variable among physicians.

**Conclusion:** Clinical pharmacists play an important integral role not only in minimizing antibiotic resistance but optimizing the appropriate use of antibiotic dose and duration. This study supports the fact that pharmacist should work in a collaborative manner with other health care professional for the sake of patient care.

**3-150**

**Category:** Infectious Diseases

**Title:** Conflicting vancomycin minimum inhibitory concentration (MIC) susceptibility reporting of *Staphylococcus aureus* isolates; an evaluative study to improve clinical practice at a state hospital

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**Purpose:** Treatment of methicillin resistant *Staphylococcus aureus* (MRSA) is dependent on various factors, including the minimum inhibitory concentration (MIC) of potential antimicrobial agents in the presence of the bacteria. Various methods can be employed in order to determine MICs, and there have been inconsistencies reported upon comparison of them. The purpose of this study was to determine the difference in MICs reported by the MicroScan WalkAway SI 40 (Siemens Healthcare Diagnostics, Deerfield, Illinois) and the Etest (bioMerieux, Durham, NC), and to ultimately optimize one aspect of antimicrobial practice in a hospital setting.

**Methods:** This evaluative study was conducted in accordance with the standards and guidelines of the Clinical and Laboratory Standards Institute (CLSI). Over a three month period, patients (n=5) treated for various different types of MRSA and methicillin sensitive *Staphylococcus aureus* (MSSA) infections had vancomycin MICs  $\leq 2$  mcg/ml, as recorded by the MicroScan. These bacterial isolates were subsequently tested via the Etest, in order to determine potential differences in testing methods. The primary outcome measure was difference in MIC recorded by the two separate testing methods; secondary outcome measures included MICs for daptomycin and ceftaroline fosamil as recorded by the Etest. This was a pharmacist led study, and the microbiological analysis was performed with the help of pharmacy interns. All patients in this study were located at a public health teaching facility that provides both acute and subacute medical care.

**Results:** All vancomycin MICs that were manually tested revealed MICs of  $< 2$  mcg/ml. The 5 isolates had an average MIC of 1.5 mcg/ml (range: 1.4 to 1.7 mcg/ml).

**Conclusion:** Vancomycin MIC results measured by the Etest were consistently lower than the MIC results recorded by the MicroScan. Going forward, automated results that show an MIC  $\leq 2$  mcg/ml will be further evaluated manually in order to determine a more precise MIC, which will help to guide clinical decisions. A larger number of isolates will provide further insight into the discrepancy that exists between the MicroScan and the Etest.

**3-151**

**Category:** Infectious Diseases

**Title:** Retrospective evaluation of intravenous vancomycin use in a rural Veterans Affairs hospital

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**Purpose:** Microorganisms have a remarkable ability to adapt and develop resistance to antibiotics. It is theorized that a "post antibiotic era" may be imminent if current antibacterial therapies are not utilized appropriately. The Infectious Disease Society of America and the Society for Healthcare Epidemiology of Americas Antibiotic Stewardship Program guidelines state that, "It has been recognized for several decades that up to 50 percent of antimicrobial use is inappropriate." According to the American College of Chest Physicians, vancomycin resistance is on the rise and it is likely it will continue to become more prevalent due, in part, to inappropriate use and dosing of vancomycin. As research leading to Food and Drug Administration (FDA) approval of new antibacterial agents has been limited in recent years, it is imperative to maintain current treatment options and limit further resistance and complications of resistance. The objective of this study was to evaluate the adherence of initial vancomycin dosing to the vancomycin policy at our health care system. Secondary outcomes were to determine which milligram per kilogram (mg/kg) vancomycin dose correlated with the best patient outcomes (time to goal trough, length of stay, and readmission within 30 days). The data obtained will be used to improve prescribing habits.

**Methods:** The Pharmacy and Therapeutics committee approved this project. The facility's vancomycin policy was updated in March 2011 and education was completed with staff. This policy was based on the American Society of Health-System Pharmacists, the Infectious Disease Society of Americas, and the Society of Infectious Diseases Pharmacists guidelines. Intravenous (IV) vancomycin use in the six months following implementation of the updated policy was evaluated in this retrospective chart review. Patients were included in the study if they received IV vancomycin during the time period and were 18 years of age or older and were excluded if they received oral vancomycin, received only one dose of IV vancomycin, or if random vancomycin levels were used in place of trough levels. Data collected included indication for vancomycin therapy, patient demographics, initial vancomycin dose, readmission within 30 days, length of stay, time to goal trough, duration of therapy, and serum creatinine. The data obtained will be used to improve prescribing habits.

**Results:** Seventy-six patients met inclusion criteria with a mean age of 70 years, mean actual body weight of 95.5 kg, mean ideal body weight of 69 kg, and mean creatinine clearance of 60 milliliters per minute (mL/min). Twenty-two percent of patients were started on a 5-9.9 mg/kg dose, 46 percent on a 10-14.9 mg/kg dose, 30.3 percent on a 15-20 mg/kg dose, and 1.3 percent on a dose greater than 20 mg/kg. Initial vancomycin dose was non-adherent to the health care systems vancomycin policy 61 percent of the time. The non-adherent doses were less than 13 mg/kg/dose 98 percent of the time with the majority of these patients also placed on shorter dosing intervals than recommended. Time to goal trough was shortest with the 5-9.9 mg/kg dose. The 15-20 mg/kg dose had the shortest length of stay and lowest readmission rates associated with its use. It also correlated with the second shortest time to goal trough.

**Conclusion:** Based on the results of this study, a vancomycin order set will be developed and education to the medical and pharmacy staff will be completed to improve adherence to the facility's vancomycin dosing policy.

**Category:** Infectious Diseases

**Title:** Validation of a vancomycin dosing nomogram in a community hospital

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**Purpose:** Increased and improper use of vancomycin has been associated with a rise in the prevalence of resistant organisms. Attention has been directed to optimizing vancomycin dosing regimens to avoid development of resistance. Hospitals utilizing a vancomycin dosing nomogram to simplify empiric doses and monitoring have been successful in achieving optimal pharmacodynamic parameters. The purpose of this study was to validate the effectiveness of a vancomycin dosing nomogram in achieving serum trough concentrations within 10 to 20 mg/dL in adult patients at a community hospital.

**Methods:** The institutional review board approved this prospective study which was conducted to evaluate the performance of a hospital-wide vancomycin dosing nomogram to achieve steady state trough concentrations within therapeutic range. Criteria for proper utilization of the vancomycin dosing nomogram included adult patients weighing greater than or equal to 40 kilograms (kg), and an estimated creatinine clearance greater than or equal to 20 milliliters per minute (mL/min). Vancomycin troughs were not drawn on all patients. Indications for vancomycin troughs included concomitant treatment with nephrotoxins, unstable renal function, vancomycin therapy longer than 5 days, hemodynamically unstable or critically ill patients, patients receiving greater than or equal to 40 mg/kg/day, dialysis or continuous renal replacement therapy, and obesity defined as actual body weight greater than 120 percent of ideal body weight. Inclusion criteria for the study were accurate selection of the vancomycin dosing regimen using the nomogram and an evaluable trough level drawn at steady state. Exclusion criteria were patients less than 19 years of age, pregnant, receiving dialysis, vancomycin was not dosed using the nomogram, or did not have a trough level drawn at steady state. The primary outcome was to determine the percentage of patients who had serum trough concentrations within therapeutic range of 10 to 20 plus or minus 1 mg/dL at steady state. Secondary outcomes included calculation of the prediction error for the trough concentration of each patient and use of this value to calculate the mean and median percent error for each patient; mean and median initial serum trough concentration; and incidence of nephrotoxicity. A Vancomycin Dosing and Monitoring Record served as the method to collect relevant data to dose and appropriately monitor vancomycin therapy. The Abbottbase Bayesian Pharmacokinetic Systems software computer program was used to determine the predicted serum trough concentration for each patient. The prediction error was calculated using the predicted and actual serum trough concentrations for each patient. The t statistic 95 percent confidence intervals (CI) were

constructed to assess differences between the nomogram predicted and actual serum concentrations. Descriptive statistics were used to analyze demographic information.

**Results:** Two hundred and twelve Vancomycin Dosing and Monitoring Records were reviewed from December 2011 to March 2012. Of these, 35 (16.5 percent) patients met criteria for inclusion for evaluation. Forty-eight percent of patients (n equals 17) had an initial serum trough concentration within 10 to 20 mg/dL and 60 percent (n equals 21) were within the range of 9 to 21 mg/dL at steady state. The mean and median prediction error on all patients was 4.98 (95 percent CI 2.69 to 7.28) and 5.15, respectively. The mean and median percent error on all patients was 22.6 percent (95 percent CI 12.1 to 32.9) and 29.4 percent, respectively. The mean and median initial trough concentration was 14.8 mg/dL (95 percent CI 12.2 to 17.4) and 12.5 mg/dL, respectively. Two patients (5.7 percent) developed nephrotoxicity while receiving intravenous vancomycin during the study period.

**Conclusion:** Overall, about half of the patients were able to obtain an initial vancomycin trough concentration within goal range of 10 to 20 mg/dL at steady state using the vancomycin dosing nomogram. Continued use of the nomogram to evaluate a larger sample size is necessary to further assess the performance of the nomogram and its role as a clinical dosing tool.

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**Category:** Infectious Diseases

**Title:** Safety of cidofovir in pediatric patients with viral infection

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**Purpose:** Adenoviruses contribute to morbidity and mortality among immunocompromised pediatric patients including stem cell and solid organ transplant populations. Cidofovir (CDV), an antiviral compound approved by FDA in 1996, is used for treatment of suspected or confirmed adenoviral (ADV) infections in immunocompromised patients despite concern of potential nephrotoxicity. At our institution we conducted a retrospective review of cidofovir use in pediatric patients to determine incidence of nephrotoxicity.

**Methods:** We conducted a retrospective five year review at Childrens Hospital Boston of 30 patients (mean age = 4.5 yrs) receiving 33 courses of CDV that included 182 infusions. During therapy all pertinent data elements were reviewed to determine response to therapy and incidence of nephrotoxicity.

**Results:** Of the 33 CDV courses, 30 (90.9%) were used for either ADV positive culture or as empiric therapy. The other 3 CDV courses were prescribed for CMV (N=2) and BK viremia (N=1). In patients who received only one dose (n=7), the average increase of serum creatinine was 16% and in patients who received more than one dose, the average increase was 53%. Patients that experienced nephrotoxicity were often prescribed concomitant nephrotoxins, particularly aminoglycosides that were significantly associated with creatinine elevations ( $p < 0.05$ ). Initiation of CDV in patients with positive ADV PCR, was associated with a trend towards rapid or eventual decrease in viral load, but this trend did not achieve statistical significance.

**Conclusion:** CDV appeared safe and reasonably well tolerated for treatment of ADV in this pediatric population but nephrotoxicity, especially with concomitant aminoglycosides, was a concerning adverse effect. Further studies of the efficacy of CDV for immunocompromised children with severe ADV infection are warranted.

**Category:** Infectious Diseases

**Title:** Cost-effectiveness of fidaxomicin for the treatment of severe *Clostridium difficile* infection in hospitalized patients in North America

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**Purpose:** Current guidelines for treatment of *C. difficile*-associated diarrhea (CDAD) recommend oral vancomycin as first line treatment for severe cases of infection. The approval of a new macrocyclic antibiotic, fidaxomicin, was based on studies showing similar initial cure rates but lower rates of recurrence. However, the price of a single course of fidaxomicin currently exceeds \$2,800 while the price of a single course of oral vancomycin is roughly \$1,200. The purpose of this study was to compare the cost-effectiveness of fidaxomicin to vancomycin for the treatment of severe *Clostridium difficile* infection (CDI) in the inpatient setting.

**Methods:** A decision analytic model was developed from the inpatient payer perspective to estimate the number of days a patient spends as an inpatient after primary infection with *C. difficile* and associated costs. Clinical data were extracted from Phase 3 clinical trials of fidaxomicin and supported by other RCTs identified by a systematic literature review. Cost data were based on available literature and adjusted to 2011 US dollars. Sensitivity analyses were performed to evaluate uncertainty in the analysis.

**Results:** A base case analysis resulted in a cost of \$8,370 per patient treated with vancomycin and \$10,469 per patient treated with fidaxomicin, an incremental cost difference of about \$2,100. Monte Carlo simulations were run and resulted in fidaxomicin being dominated by vancomycin; treatment with vancomycin provided an incremental benefit of 93 hospital days averted per 100 patients with CDI and resulted in a cost savings to the hospital of \$2,900 per patient. Sensitivity analyses showed that fidaxomicin becomes the more cost-effective option if more than 25.7 days are spent in the hospital for treatment of relapse; otherwise vancomycin remains the less costly option. Sensitivity analyses also demonstrated that in order for fidaxomicin to become the more economical option, the cure rate for vancomycin would need to decrease below 75.6%.

**Conclusion:** This cost-effectiveness analysis demonstrated that fidaxomicin costs approximately an additional \$2,100 per patient with CDI and results in a length of stay that is slightly greater than if the patient had been treated with vancomycin. In other words, vancomycin is a less costly treatment strategy for most patients with CDI because it costs less and results in fewer patient-

days spent in the hospital. Fidaxomicin may be a cost-effective treatment in patients who are older, have comorbidities, have secondary or hospital-acquired CDI, are on concomitant antibiotics or are at high risk for relapse. Otherwise, vancomycin appears to be a preferable strategy to payers who seek to maintain cure rates and minimize costs for patients hospitalized with severe CDI.

**Category:** Infectious Diseases

**Title:** Evaluation of a pharmacy-monitored procalcitonin protocol in community-acquired pneumonia

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**Purpose:** Procalcitonin is a biomarker produced by multiple tissues in response to a bacterial infection. Studies have shown that procalcitonin serum levels appear to correlate with the extent and severity of infection. This preferential release may help differentiate between bacterial and viral infections and guide therapy in patients with suspected bacterial infections. This study evaluated the use of a pharmacy-monitored procalcitonin protocol incorporated into the community-acquired pneumonia pathway for Lutheran Hospital of Indiana. With initiation of the protocol, the clinical pharmacist could recommend de-escalation or discontinuation of antibiotic therapy based upon the procalcitonin levels and patient clinical status. The primary objective of the study was to evaluate the impact of the pharmacy-monitored protocol in community-acquired pneumonia on length of stay and total hospital inpatient admission charges. A secondary objective was to evaluate the appropriate monitoring of a random sampling of all patients who had a procalcitonin level drawn.

**Methods:** A retrospective review of all community-acquired pneumonia patients was conducted from September 2011 through March 2012. These patients were divided into those who had procalcitonin levels monitored by pharmacy versus those who did not. Each group was analyzed, comparing overall length of stay (LOS) and total hospital inpatient admission charges. Fifty patients were then randomly chosen from all community-acquired pneumonia patients who had a procalcitonin level drawn. These patients were evaluated for compliance with the approved procalcitonin monitoring protocol and appropriate recommendations for adjustment of therapy.

**Results:** A total of 234 patients were admitted with the diagnosis of community-acquired pneumonia. Procalcitonin monitoring by pharmacy was ordered for 75 of these patients. Comparing the average length of stay for the two groups, the group of patients monitored by pharmacists had an average length of stay of 5.3 days versus 4.5 days for the non-procalcitonin-monitored group. When looking at total hospital inpatient admission charges, designating "1" as the overall average charge per stay, the procalcitonin patient charges were 1.22 versus 0.95 for the non-procalcitonin-monitored patients. Of the 50 patients randomly selected from 648 patients who had procalcitonin levels drawn, 31 were physician-monitored versus 19 patients monitored by pharmacy. Pneumonia was the primary diagnosis in 38 patients with 6 other diagnoses

accounting for the remaining 12 patients. Obtaining a recommended initial baseline procalcitonin level was not being completed by the physician-monitored patients. In those monitored by the pharmacy, the recommended 24 hour or follow-up levels were only ordered appropriately in 6 patients. Pharmacy recommendations for antibiotic changes were provided for only a few patients, but none were ultimately implemented by physicians in this sample of patients.

**Conclusion:** The overall costs and length of stay for the procalcitonin group were higher than the group who did not have procalcitonin levels ordered. From these results, it is apparent that compliance with the protocol and pharmacist and physician acceptance of procalcitonin levels as a monitoring tool is very low. Future plans for improvement are to meet with pharmacy and medical staff to evaluate and revise the protocol as needed. The goal is to conduct a revised training program with greater emphasis on assessment of patient clinical status. The protocol will be reinitiated and reevaluated in 6 months, and will include an assessment of patient outcomes.

**Category:** Infectious Diseases

**Title:** Impact of antibiotic stewardship program on the treatment of asymptomatic bacteriuria at an inpatient rehabilitation hospital

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**Purpose:** Overuse of antibiotics can lead to the development of resistance, unnecessary cost and adverse effects. There is little published experience on the antibiotics stewardship programs (ASP) at inpatient rehabilitation facilities. At our 120 bed free standing rehabilitation hospital, urinary tract infection (UTI) is the most common indication for the antibiotics use. Despite the presence of evidence-based guidelines on the diagnosis and management of UTIs vs asymptomatic bacteriuria (ASB), ASB is often misdiagnosed as UTI and inappropriately treated. The purpose of this study was to evaluate the effectiveness of ASP lead by multi-professional team supported by physicians, nurses and pharmacists in reducing the treatment of ASB.

**Methods:** The most common antibiotics identified for UTI at our facility were ciprofloxacin, trimethoprim/sulfamethoxazole and nitrofurantoin. The retrospective review was conducted and data was collected before the development of guidelines and education (Period 1: Sep 2011- Oct 2011) and after the ASP was fully implemented (Period 2: Apr 2012-May 2012). Data collection included the review of all patients that received the above mentioned antibiotics and patients were classified as having UTI or ASB by applying the guidelines and reviewing the rationale for antibiotics use. Period 1 used a stewardship model of pharmacist performing concurrent review and feedback. ASP team was created in Nov 2011 and concise guidelines defining UTI and asymptomatic bacteriuria (ASB) as well as unnecessary antibiotics treatment were developed and approved by Pharmacy and Therapeutics committee. Education on guidelines and definitions was provided to all physicians and pharmacists, and it was mandatory for all nursing staff. New nursing documentation screen UTI surveillance was created in Meditech; nursing staff was educated on the use of this documentation tool. Physicians were encouraged to document rationale for starting antibiotics in progress notes. Senior administrative team supported the ASP increasing the visibility and importance of this program. Pharmacist concurrent review and feedback continued unchanged however the interventions became easier due to nursing documentation and education on definitions and guidelines. Our review was limited to enteral antibiotics as majority of prescriptions ordered for treatment of UTI were enteral. We excluded all patients who were receiving antibiotics upon admission and who were prescribed above mentioned antibiotics for reasons other than UTI. Days of therapy (DOT) was estimated by dividing total number of doses dispensed by usual prescribing frequency for each drug.

**Results:** A total of 500 patients were admitted in period 1 out of which 99 patients were prescribed above mentioned antibiotics with an indication of UTI (19.8 per 100 admissions). In period 2 there were 464 patients admitted out of which 36 patients were prescribed antibiotics with an indication of UTI (7.7 per 100 admissions). Thus there was a 61% decline in overall prescriptions of antibiotics for UTI without any adverse patient outcomes. The antibiotics DOT/1000 patient days changed from 44 in period one to 25 in period two, thus showing a decline of 43%. Further review of pharmacists interventions revealed that 33 out of 50 (66%) patients in period 1 and 10 out of 36 (28%) patients in period 2 received antibiotics for treatment of ASB, thereby decreasing the treatment of ASB by 59% in period 2.

**Conclusion:** Antibiotic prescribing for UTI is common in the inpatient rehabilitation. A pharmacist review and feedback model focused on the prescribing role of the physician but did not address the role of nursing in prompting physicians to diagnose UTI and prescribe antibiotics. Setting a specific institutional goal, active administrative support, developing clear definitions & guidelines, and engaging nurses as well as physicians in an ongoing ASP dramatically improved performance by reducing the treatment of ASB thus leading to reduced antibiotic use.

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**Category:** Infectious Diseases

**Title:** Evaluating the appropriateness of an antimicrobial intravenous to oral conversion protocol compared to antimicrobial stewardship recommendations in a veterans affairs health care system.

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**Purpose:** Intravenous to oral (IV to PO) antimicrobial conversion is an established component of antimicrobial stewardship programs. Currently, literature is lacking regarding the clinical appropriateness of an automatic IV to PO protocol. The purpose of this study was to determine the effectiveness and appropriateness of a piloted automatic IV to PO conversion protocol compared to the clinical decisions recommended by the Antimicrobial Stewardship Team (AST).

**Methods:** A prospective pilot study was conducted from December 2011 to May 2012 to evaluate a piloted IV to PO conversion protocol. Patients meeting IV to PO criteria were presented to the AST with a recommendation to convert IV to PO or an alternative antimicrobial recommendation. Interventions were documented in the electronic medical record and conveyed verbally to the primary medical or surgical team. The decision to accept or deny the ASTs recommendations resided with the medical or surgical team. Data was compared using appropriate statistical analysis.

**Results:** A total of 99 patients were eligible for IV to PO conversion and presented to the AST. Recommendations to convert to oral therapy were made 46.5 percent of the time and alternative recommendations were made in 53.5 percent of patients eligible for conversion. The convert IV to PO group was comprised of 43 males, had a mean age of 68 plus minus 15.1 years, and a mean serum creatinine of 1.81 plus minus 1.72 mg/dL. The alternative recommendation group was comprised of 50 males, had a mean age of 69 plus minus 13.6 years, and a mean serum creatinine of 1.49 plus minus 0.87 mg/dL. Conversion to oral therapy was accepted 73.9 percent of the time. Alternative interventions were accepted 88.7 percent. Alternative recommendations consisted of discontinue antibiotic (45.3 percent), change antibiotic (34 percent), and continued observation required (19 percent). Patients met oral conversion criteria, on average, at 3.6 days. Indeed, 52.5 percent of all patients met oral conversion criteria on days one or two. Cost avoidance for the IV to PO group was 37,944 dollars and the alternative recommendation group was 3,578.34 dollars. The defined daily dose cost savings for the IV to PO group was 294.68 dollars.

**Conclusion:** An automatic IV to PO antimicrobial conversion protocol may not always be appropriate. The AST had an alternative recommendation 53.5 percent of the time. Furthermore,

the majority of patients met criteria for oral antibiotic conversion within 2 days, implicating perhaps AST may have a role in the initiation of appropriate antibiotic therapy. Further studies need to be completed to confirm these results.

**3-158**

**Category:** Infectious Diseases

**Title:** Outcomes following implementation of an antimicrobial stewardship program in a 154-bed community hospital

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**Purpose:** St. Lukes The Woodlands Hospital is a 154-bed community hospital with 22 ICU beds located in a suburb north of Houston. An antimicrobial stewardship program (ASP) was instituted in this hospital in April, 2010. Staff involved in the ASP included a part-time infectious diseases physician and clinical pharmacists. Consultation with other hospital staff, including microbiologists and an infection control practitioner, was made as needed. The purpose of this project is to delineate early outcomes of an ASP in a community hospital.

**Methods:** The outcomes of ASP are evaluated from April 2010 to December 2011. The use of broad-spectrum and high-cost antibiotics, including carbapenems, piperacillin-tazobactam (P/T), tigecycline, daptomycin, linezolid, and micafungin, was audited two to five days per week. Simultaneously, hospital guidelines were developed, including treatment guidelines for community-acquired pneumonia, hospital-acquired pneumonia, intra-abdominal infections, and MRSA infections. In addition, a policy was implemented for the automatic discontinuation of antibiotics after a fourteen-day course, unless re-ordered and a reason for continuation documented. Feedback was provided to prescribers when antibiotic selection was deemed inappropriate, per established guidelines, and/or when antibiotic de-escalation was indicated. Additional interventions from ASP team included: antibiotic renal dosing adjustment; conversion of intravenous antibiotics to oral antibiotics, as appropriate; requests for documentation of infection requiring antibiotic therapy and for length of therapy plan; and prompting isolation precautions when a drug-resistant pathogen was identified.

**Results:** On average, 50 cases per month were reviewed by ASP in 2010 (April to December), and 58 cases per month in 2011. Antimicrobial cost per pharmacy adjusted patient day (PAPD) has decreased from \$20.61/PAPD in 2009, to \$17.07/PAPD in 2010, and to \$14.89/PAPD in 2011, with a cost reduction of 27.8%. In 2009, 2010, and 2011, P/T cost was \$4.27/PAPD, \$2.39/PAPD, and \$1.63/PAPD, respectively; meropenem cost was \$2.27/PAPD, \$1.74/PAPD, and \$0.73/PAPD, respectively. Furthermore, Gram-negative resistance rates have been reviewed.

In 2007, 2009, and 2011, *Escherichia coli* (*E. coli*) resistance rates to P/T were 0%, 2%, and 10%, respectively; *E. coli* resistance rates to carbapenem were 0%, 0%, and 2%, respectively. In 2007, 2009, and 2011, *Klebsiella pneumoniae* (*K. pne*) resistance rates to P/T were 6%, 10%, and 9%, respectively; *K. pne* resistance rates to carbapenem were 0%, 2%, and 15%, respectively. In 2007, 2009, and 2011, *Pseudomonas aeruginosa* (*P. aer*) resistance rates to P/T were 13%, 13%, and 7%, respectively; *P. aer* resistance rates to carbapenem were 15%, 13%, and 21%, respectively.

**Conclusion:** An ASP involving chart audit and feedback to prescribers has been implemented in a community hospital. Twenty months after the initiation, a significant decrease in antibiotic usage and cost has been demonstrated. Early outcomes have revealed a decrease in *P. aer* resistance to P/T. However, no decrease of gram-negative resistance involving other pathogens against carbapenems or P/T has been shown as an early outcome.

**Category:** Infectious Diseases

**Title:** Evaluation of the appropriateness of antimicrobial dosing in critically ill patients receiving continuous renal replacement therapy

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**Purpose:** The dosing of antimicrobial agents in the setting of infection and acute kidney injury continues to be a significant challenge to the care of critically ill patients. These patients often have complicated confounding pharmacokinetic factors that make dosing antimicrobial agents fairly difficult, especially when acute kidney injury necessitates the need for continuous renal replacement therapy (CRRT). Using recommendations from current literature to determine antimicrobial regimens in patients receiving CRRT can serve as a useful measure to potentially optimize patient outcomes and decrease the risk of antimicrobial resistance. The purpose of this study is to evaluate and analyze the appropriateness of antimicrobial dosing in selected critically ill patients who have received CRRT over the course of their hospital stay at Robert Wood Johnson University Hospital (RWJUH).

**Methods:** The institutional review board approved this electronic retrospective chart review that included patients who were hospitalized at RWJUH from August 2010 through July 2011. Patients were identified via computer-generated synopses of continuous renal replacement therapeutic modalities. Recruitment of patients included all those who were at least 18 years of age at the time of hospitalization and received at least one antimicrobial agent while on CRRT. Once patients were identified as meeting eligibility criteria, the following information was collected: patient demographics, length of stay in the intensive care unit (ICU) and overall hospital stay, cause of death (if applicable), modality and duration of CRRT, and antimicrobial agent selection and dosing schedule during CRRT. In addition, the presence or absence of infectious disease consultation and/or pharmacist intervention in making adjustments to therapy over the course of hospital stay was noted. Appropriateness of antimicrobial dosing was determined based on published recommendations provided by Heintz et al.

**Results:** A total of 61 patients were identified over the one-year study period. The modality of CRRT utilized in all patients was continuous venovenous hemodiafiltration (CVVHDF), with a mean duration of 7.2 days. A total of 172 courses of antimicrobial agents was administered to 61 patients receiving CRRT simultaneously, of which 87 (50.6%) were dosed appropriately. Involvement of a clinical specialist increased the probability of appropriate dosing of administered courses of antimicrobial agents. Consultation by an infectious disease physician

was observed in 43 of the 87 (49.4%) courses of antimicrobials dosed appropriately. Pharmacist intervention was documented in 23 of the 87 (26.4%) courses of antimicrobials dosed appropriately. The majority of inappropriate dosing occurred secondary to under-dosing of the antimicrobial agent, which was observed in 80 of the 85 (94.1%) courses of antimicrobial agents dosed inappropriately; 26 (30.6%) originated from consultation by an infectious disease physician, 13 (15.3%) occurred with pharmacist intervention, and 46 (54.1%) did not have involvement of a clinical specialist. Agents that were most commonly implicated with inappropriate dosing were piperacillin/tazobactam, vancomycin, levofloxacin, fluconazole, and imipenem/cilastatin, which also accounted for over 75% of the total courses of antimicrobial agents prescribed to patients undergoing CRRT. Of the 61 patients, 35 died during hospitalization, with 80% of deaths occurring secondary to septic shock.

**Conclusion:** Commonly prescribed antimicrobial agents are often inappropriately dosed in patients undergoing CRRT. There is a greater need for clinician education and involvement of clinical specialists to improve the rate of appropriate antimicrobial dosing in critically ill patients receiving CRRT. It is anticipated that this study will serve as a basis for the development and implementation of institutional guidelines related to dosing of antimicrobial agents for inpatients receiving CRRT. This may potentially reduce patient morbidity and mortality, shorten the length of hospital stay, and decrease the risk of the development of antimicrobial resistance.

**3-160**

**Category:** Infectious Diseases

**Title:** Evaluating the correction of antibiotics using information in a public pharmacy (Mongagua, Brazil)

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**Purpose:** The first descriptions of antimicrobials using age about 3000 years, when chinese physicians used mold to treat inflamed tumors and infected wounds. However, the broad use of antibiotics really started after 1942 of the common era, when penicillin started to get used in medical practice, starting a new era in therapeutic clinics. The purpose of this study was to verify the accuracy of patients information regarding safe use of prescribed antibiotics.

**Methods:** We performed a prospective study, through data collection with a standardized questionnaire applied to 107 individuals aged 18 or more, who received antibiotics with a medical prescription at Public Municipal Pharmacy and Warehouse in the City of Mongagua (State of Sao Paulo, Brazil). Data were collected in the months of may and june 2011. Public pharmacies are ones where multiple standardized drugs are available for the public at no cost, dispensed by a pharmacist, once the patient shows a medical prescription. Many antibiotics in Brazil were sold at drugstores as over-the-counter medication, until a recent change in legislation: from November 2010 on, all antibiotic drugs should be sold uniquely according to medical double-sheet prescription, and data about the patient should be collected, in order to restrain the promiscuous self-medication with this class of drugs. The ethics committee approved the project and registered it at UNISANTA (University Santa Cecilia) under the number 08/2011.

**Results:** 57% of the evaluated patients correctly informed on which system or organ should the drug perform its action. 89% of them reported being oriented on how to use the medication. 21% reported using concomitant medication. 88% did not know its adverse effects. 21% of the responding sample reported having withdrawn a treatment before. 77% didnt know what were the effects of interrupting treatment. 58% ignored the reason why these drugs should be sold strictly with medical prescription.

**Conclusion:** Computing the collected data above, we consider extremely necessary to establish a clearer and more realistic pharmaceutical attention approach. Health teams should be aware of the importance of correctly teaching the patients about dosis, frequency of administration, treatment duration, withdrawal implications, adverse effects and concomitant incompatibilities,

in the moment of medical consultation/prescription and/or drug dispensation, role which is fundamentally exerted by the pharmacist, who should practice a service of pharmaceutical attention and oriented dispensation, whether by pharmacotherapeutic follow-up, or by educative interventions through health campaigns, or attempting to detect incorrectly prescribed substances and performing pharmaceutical interventions when appropriate.

**3-161**

**Category:** Infectious Diseases

**Title:** Financial Impact of Multi-disciplinary Team Led Antimicrobial Stewardship Initiative

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**Purpose:** Antimicrobial resistance is a global epidemic and clinicians are often confronted with the challenge of limited availability of agents for disease management. Rationale use of antimicrobial agents is the only solution to deal with this problem. We describe the financial impact of infectious disease-pharmacy managed antimicrobial stewardship program in our academic health system.

**Methods:** The infectious disease and pharmacy team made a collaborative initiative to promote stewardship practice among the clinicians. The group worked with various specialties to develop standardized evidence based infectious disease management protocols. The protocols were promoted at various groups before implementation. Restrictions were placed on use of specific broad spectrum agents. In addition, the team decided to monitor broad spectrum agents on a prospective basis. A physician, pharmacists, pharmacy residents and students reviewed clinical justification of use on a daily basis and made interventions as needed. The process also served as an educational tool for the medical and surgical residents.

**Results:** Our annual antimicrobial cost prior to the implementation of the program was \$5.2 million and the cost came down to \$4.1 million in the last fiscal year. Antimicrobial cost per patient day came down from \$23.46 to \$18.43 (21% cost reduction). In addition, we have observed a significant decrease of broad spectrum agents in our system.

**Conclusion:** We conclude that collaboration between infectious disease and pharmacy can achieve antimicrobial compliance leading to cost savings and reduced use of broad spectrum agents. the initiative leads to positive patient care outcome.

**3-162**

**Category:** Investigational Drugs

**Title:** Quantifying the financial impact of investigational drug services in a large, not for profit, tertiary academic medical center

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**Purpose:** While many healthcare organizations are involved in pharmaceutical research, no standard approach exists to adequately evaluate the financial impact of participation in drug studies. Failure to quantify the profit or loss related to drug research is due, in part, to the fact that many of the widely accepted benefits of participation such as impact on physician recruitment, market penetration, and public perception are difficult to assess. Cost avoidance is a somewhat universally accepted benefit of participating in drug research, but the magnitude of its impact is often falsely inflated due to issues such as: lack of a standard definition of what constitutes cost avoidance; use of patient charges instead of acquisition costs; failure to consider payor mix; and failure to consider the differences in inpatient and outpatient reimbursement models. In some cases, cost avoidance resulting from drug studies is not tracked at all, but its impact is assumed to offset the negative margins often seen when evaluating related expenses and billing revenue in isolation. The desire to accurately report the financial impact of research on the Pharmacy Department budget prompted a large, not for profit, tertiary academic medical center to develop a mechanism to accurately calculate and report the expenses, revenue, and cost avoidance related to research activities.

**Methods:** The Program Director of the Investigational Drug Service developed a dashboard to track and report Pharmacy-related expenses, revenue, and cost avoidance related to drug studies across the organization. Input from senior leadership was sought to develop a standard definition for cost avoidance. "Gross cost avoidance" was defined as the actual acquisition cost of the therapeutic alternative to the provided medication that was averted due to a subject's participation in a study. "Net cost avoidance" was defined as the gross cost avoidance adjusted for payor mix, service line (Oncology vs. non-Oncology) and inpatient/outpatient reimbursement models. Gross cost avoidance pursuant to each patient encounter was calculated for all active protocols and reported monthly.

**Results:** For many studies of novel therapies, use of no therapeutic alternative was averted and no cost avoidance was recognized. This was sometimes true even when the agent being studied was FDA-approved for indications other than that being studied in the clinical trial. The majority of gross cost avoidance (99 percent) resulted from outpatient Oncology studies. Nearly all cost avoidance from non-Oncology studies resulted from inpatient trials (95 percent). The calculated net cost avoidance was 10.9 percent of gross cost avoidance. While charged with being "budget neutral", the service posted a substantial positive margin during the fiscal year when cost avoidance was considered.

**Conclusion:** Development of a standard definition of cost avoidance and application of such in the context of payor mix and reimbursement models can aid in accurate assessment of the financial performance of an investigational drug service. Failure to adjust for payor mix and patient type would have resulted in a ten-fold overestimation of realized cost avoidance in our institution. In the future, the concept of "lost revenue" for insured outpatients enrolled in clinical trials needs to be explored.

**3-163**

**Category:** Leadership

**Title:** Use of interactive polling to incorporate multiple perspectives into the pharmacy practice model initiative (PPMI) hospital self assessment

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**Purpose:** The pharmacy practice model initiative (PPMI) hospital self assessment was developed for hospital pharmacy departments to gauge their alignment with the recommendations from the PPMI summit. The pharmacy department at this large tertiary care hospital used the hospital self assessment survey to incorporate a broad range of perspectives regarding current and future pharmacy practice in terms of PPMI. A secondary outcome was to assess any gaps in the pharmacists knowledge of the current practice model and to identify areas to focus on to improve future pharmacy practice.

**Methods:** A meeting time was chosen for Monday, November 28th 2011 from 4 to 6pm. All pharmacists were invited to attend. A brief description of PPMI, the purpose of the PPMI self assessment, and self assessment questions themselves were sent to all pharmacists for review. The meeting was introduced by the Pharmacy Director and the subsequent self assessment questions were posed in turn by the chairs of the Pharmacy Practice Council and the Education Council. All 106 questions were transcribed into Power Point format and scored using an audience response system displaying immediate real time results.

**Results:** Sixty five pharmacists were invited to participate in the PPMI self assessment with thirty actually participating (46%). The pharmacists surveyed included nine pharmacy managers/coordinators/directors, four staff pharmacists, fourteen clinical pharmacists, two residents and one pharmacist from corporate. All 106 questions were answered within the two hour time frame. Due to time constraints, results from each of the 106 questions were discussed at a later date. Of the 106 questions, 27 questions were identified as areas for further evaluation due to lack of consistency in responses.

**Conclusion:** Performing the PPMI hospital self assessment in this group setting was helpful in incorporating a range of pharmacy perspectives spanning from resident to director. The results of the survey allowed the department to assess potential knowledge gaps and identify areas in need of improvement throughout the entire pharmacy department.

**3-164**

**Category:** Leadership

**Title:** Collaboration between South Sudanese immigrants and American health care workers results in a proposal with potential international impact

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**Purpose:** Years of war have left the Republic of South Sudan almost devoid of trained healthcare professionals. According to the Ministry of Health Health Sector Development Plan there are only 1.5 physicians and 2 Nurses/Midwives for every 100,000 citizens living in South Sudan. The South Sudanese diaspora in Rochester, MN and officials from South Sudan asked locally for help in improving healthcare in South Sudan. The purpose of this collaboration was to identify a specific area of need in which volunteer health care workers in Rochester could assist in improving health care delivery in South Sudan and to determine actions necessary to meet that identified need.

**Methods:** A group of volunteers led by a pharmacist and pulmonary physician and composed of medical students, healthcare workers and South Sudanese immigrants was formed. The group is called ROSS (Rochester for South Sudan). A series of meetings was convened to discuss the multiple requests from local South Sudanese and officials in South Sudan with close ties to the Rochester community. Focusing on one sustainable project was a challenge. During a visit to Minnesota the vice president of South Sudan introduced the ROSS co-chairs to a U.S. physician with extensive global health involvement and 4 years of experience in South Sudan. This physician was able to provide ROSS with a feasible project idea that would address the immediate need for equipment to manage respiratory diseases, a major cause of morbidity and mortality in South Sudan. A grant opportunity from The Rotary Club of Rochester with matching funds from Rotary International was identified for application to support the project. Contact was also made with the president of the Juba chapter who partnered with the Rochester chapter.

**Results:** A grant was submitted for respiratory equipment (oxygen concentrators, flow splitters and pulse oximeters) and associated DVD-based medical school curriculum development. The equipment will deliver oxygen to an estimated 1200 children per year at Juba Teaching Hospital. Two educational modules will be developed: 1) Pediatric Pulmonary disorders; 2) Equipment upkeep and maintenance associated with the respiratory equipment supplied by the grant. The education modules will be a collaborative effort between medical students in the U.S. and in South Sudan. The training will initially serve the 354 medical students enrolled at Juba

University. Plans are also underway to use the DVD-based program in Yambio, another city in South Sudan.

**Conclusion:** Networking with local immigrants can lead to valuable contacts in their home country. In this case, collaboration between health care workers and local immigrants led to a grant application for a project aimed to improve care of patients with respiratory diseases in South Sudan. Community involvement has the potential to enhance global healthcare capacity.

**3-166**

**Category:** Leadership

**Title:** Development of a structured, university-supported program to assist students in the post-match residency scramble

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**Purpose:** The pursuit of post-graduate residency training is competitive and there is an increasing disparity between the number of applicants and available positions. In 2012, approximately 40% of residency applicants did not match with a PGY-1 program. This resulted in 1438 students competing for 145 open positions. There are currently no guidelines or rules governing the post-match scramble for residency positions. Students frequently navigate this process with minimal supervision and guidance under extreme time pressures. This project was designed to develop and assess a structured, centralized and university-supported process for assisting unmatched students during the post-match residency scramble.

**Methods:** In 2010, the faculty identified a need to comprehensively support students pursuing PGY-1 residency positions. A meeting involving key faculty members and administrators was convened to address this need. A comprehensive support process was developed and key individuals and resources were identified. Faculty, students and preceptors were notified in advance that the student support services would be provided on campus on the day match results were released. Students entering the match were requested to supply electronic copies of their CV, and a list of references in advance. Students Affairs staff coordinated access to student transcripts, a conference room, communications technology and food. Residency-trained faculty members were scheduled to provide consultations with students to identify potential programs and develop a strategy to pursue available positions. Student experiences and perceptions of the process were assessed through a post-scramble survey.

**Results:** In 2011, 8 students did not match with PGY-1 programs and chose to participate in the residency scramble process. In 2012, the number of unmatched students rose to 10. These results are consistent with national averages. Over 80% of the unmatched students in both years proceeded to a pre-defined campus location for university-supported assistance. On average 2 faculty members were available in person to support students on campus. Where appropriate, faculty members made direct contact with programs via phone calls and emails to advocate for students applications. In 2011, participating students received at least 6 phone interviews and on-site interviews during the scramble. No students from either year obtained a residency position in

the scramble. One student from the class of 2011 accepted a residency position to start July 2012. Overall student feedback was positive regarding the level of guidance and support.

**Conclusion:** The post-match residency scramble process is extremely competitive and stressful for students. The comprehensive support for students helped position them to quickly identify and prioritize available residency positions, and obtain interviews with programs. Additional curricular offerings have been developed to better prepare students to navigate this process. There continues to be a need to develop a structure and guidelines to govern this process on a national level.

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**Category:** Nutrition Support

**Title:** Retrospective assessment of the efficacy of a pancreatic enzyme protocol for clearing occluded enteral tubes

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**Purpose:** In a previous prospective study, a protocol using alkalinized Viokase pancreatic enzyme tablets restored patency to 71.9% of occluded Dobbhoff tubes. However, Viokase tablets were removed from the U.S. market in late April 2010. Subsequently, the standard protocol for unclogging enteral tubes in a University Hospital was adapted to include Creon pancreatic enzyme capsules, despite the lack of published data for this indication. The purpose of this study was to evaluate the effectiveness of a Creon-based protocol to clear occluded enteral tubes in a University Hospital.

**Methods:** The University of Michigan Institutional Review Board approved this retrospective assessment of all patients seen in the Emergency Department or in an inpatient setting who received Creon capsules for clearing occluded enteral tubes according to a standard protocol between May 1 and November 30, 2010. The protocol called for addition of the contents of one Creon (12,000 units lipase, 60,000 units amylase, 38,000 units protease) capsule to a single sodium bicarbonate 650 tablet dissolved in 5 to 10 mL water. Once the enteric coated granules of Creon were dissolved, the solution was to be instilled into the occluded tube under light pressure and clamped for 5 to 15 minutes, followed by use of a back and forth plunger motion to dislodge the clog. The Creon protocol was deemed effective if tube clearance was documented in the medical record or if enteral feedings were resumed with no note regarding tube replacement.

**Results:** A total of 104 patients were ordered Creon for clearing occluded enteral tubes during the 7-month study period. The alkalinized Creon protocol was subsequently implemented in 83 patients ranging in age from 2 months to 93 years (median, 55 years) presenting with a total of 118 clogged tubes. The clogged tubes included 55 (46.6%) Dobbhoff, 27 (22.9%) jejunostomy, 13 (11.0%) percutaneous endoscopic gastrostomy (PEG), 12 (10.2%) gastrostomy-jejunostomy and 11 (9.3%) other tubes. Due to poor documentation in the medical record, the efficacy of Creon could not be determined in 3 cases. These cases were subsequently excluded from the data, leaving 115 occluded tubes available for analysis. Patency was successfully restored to 53 tubes, a clearance rate of 46.1%. More than one treatment course was attempted in only five

cases, with success in three. When three cases reported to be clogged due to kinking or coiling of the tubes were excluded from the data, the clearance rate increased to 47.3%. No adverse effects were attributed to Creon administration.

**Conclusion:** The 46.1% rate of clearance of occluded enteral tubes with a Creon-based protocol in this retrospective study was much less than that previously reported in a prospective study with Viokase. These conflicting findings may potentially be explained by differences in the types of enteral tubes included in these studies and in the concentrations of pancreatic enzymes and sodium bicarbonate in the Creon- and Viokase-based protocols. Unlike Viokase tablets, Creon consists of enteric coated granules, which if not fully dissolved, might also have impacted the ability to clear the tube. In addition, it is unclear whether all aspects of the Creon protocol were adhered to in this retrospective study.

**Category:** Oncology

**Title:** Antiemetic efficacy and safety of aprepitant in multiple-day chemotherapy for hematological malignancies

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**Purpose:** Aprepitant has been shown to improve the control of chemotherapy-induced nausea and vomiting (CINV). However, the usefulness of aprepitant in patients receiving multiple-day chemotherapy for hematological malignancies still remains unclear. Therefore we evaluated the antiemetic efficacy and safety of aprepitant in the moderately to highly emetogenic multiple-day chemotherapy for the patients with hematological malignancy.

**Methods:** The protocol of this study was approved by the Ethics Committee. All data were retrospectively collected from the electric medical record system. The subjects were 82 adult patients with hematologic malignancies who received multiple-day chemotherapy: 42 patients were treated with aprepitant and granisetron as antiemetic prophylaxes between April 2010 and December 2010 (aprepitant group); 40 patients were treated with only granisetron between March 2009 and March 2010 (control group). The patients in both groups were received 3 mg of granisetron intravenously 30 min before administration of anticancer drugs. In the aprepitant group, 125 mg of aprepitant was administered orally 60-90 min before administration of the first moderately to highly emetogenic anticancer drugs (day 1). On day 2 or thereafter, 80 mg of aprepitant was administered orally every morning until the last administration of moderately to highly emetogenic anticancer drugs. The primary endpoint was to evaluate the percentage of patients who achieved complete response (CR, no vomiting and no use of rescue medication). Secondary endpoints included the percentages of patients without nausea and vomiting, and the incidences of other adverse drug events (ADEs). To identify the factors associated with non-CR, the stepwise logistic regression analysis was conducted.

**Results:** The percentage of patients who achieved CR in the aprepitant group was significantly higher than that in the control group (76% vs. 50%,  $P=0.01$ ). Stepwise logistic regression analysis showed that the predictors significantly associated with non-CR were prophylactic use of aprepitant [odds ratio (OR) =0.30; 95% confidence interval (CI), 0.11-0.79,  $P=0.01$ ] and chemotherapies containing 4 g/m<sup>2</sup>/day or higher dose of cytarabine (OR=3.31; 95% CI, 1.11-10.42,  $P=0.03$ ). The incidences of ADEs were not much different between the two groups.

**Conclusion:** The addition of aprepitant to granisetron enhances the antiemetic effect without influencing ADEs in patients receiving moderately to highly emetogenic multiple-day chemotherapy for hematological malignancies.

**Category:** Oncology

**Title:** Assessment of compliance with American Society of Clinical Oncology (ASCO) guidelines for the screening and management of bone health in breast cancer patients

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**Purpose:** About one in eight US women will develop breast cancer in their lifetime. Breast cancer treatments can result in accelerated direct and indirect bone loss. Additionally, 75% of women with advanced breast cancer will develop bone metastases, 64% of whom will experience a skeletal-related event within two years. Thus, screening for and maintaining bone health among women with breast cancer is important to overall health in this population. The purpose of this study was to determine if high-risk, non-metastatic breast cancer patients as well as breast cancer patients with bone metastases at the Sidney Kimmel Comprehensive Cancer Center (SKCCC) are receiving appropriate screening and management for bone health based on the ASCO guidelines.

**Methods:** The institutional review board approved this six month retrospective chart review. Females greater than 18 years of age were included if they had a primary breast cancer diagnosis stage I to III and were considered high-risk for osteoporosis based on the criteria listed in the ASCO guidelines. They were also included if they had a primary breast cancer diagnosis stage IV with bone metastases. The primary endpoint was compliance with ASCO guidelines for bone health in stage I to III high-risk, non-metastatic breast cancer patients. This was assessed using the 2003 ASCO guidelines for bone health issues in women with breast cancer. For these patients, compliance was considered if patients received DEXA scans, took calcium and vitamin D, and were managed appropriately with or without bisphosphonates based on their T-scores. The secondary endpoint was compliance with ASCO guidelines for bone health in stage IV breast cancer patients with bone metastases. This was assessed using the 2011 ASCO guidelines on the role of bone-modifying agents in metastatic breast cancer. For these patients, compliance was considered if patients were receiving calcium and vitamin D as well as bisphosphonates. Data was collected via electronic patient records and descriptive statistics were conducted on all outcome measures.

**Results:** 55% of the high-risk, non-metastatic breast cancer patients were appropriately screened and managed for bone health, and were therefore compliant with the ASCO guidelines. 82% of these patients received DEXA scans, 68% were on calcium and vitamin D, and 50% of the patients who had indications for bisphosphonates were receiving them. 36% of the metastatic breast cancer patients with bone metastases were managed appropriately for bone health. 36% were on calcium and vitamin D, while 82% were receiving bisphosphonates.

**Conclusion:** Compliance with the ASCO guidelines for the screening and management of bone health in breast cancer patients at the SKCCC at Johns Hopkins Bayview Medical Center is low, especially in patients with bone metastases. Education of both providers and patients on the importance of bone health can improve the compliance rate.

3-170

**Category:** Oncology

**Title:** Development of an antibiotic algorithm for febrile neutropenia

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**Purpose:** In January 2011 the Infectious Disease Society of America (IDSA) published guidelines with recommendations for the management of cancer patients with febrile neutropenia. Currently our institution has no formal guidelines for the management of febrile neutropenia. The purpose of this project is to improve compliance with IDSA guidelines involving patients with febrile neutropenia at UAB Hospital.

**Methods:** Patients treated for febrile neutropenia from October 1, 2011 to March 31, 2012 were included in this review. The primary objective was to assess practitioner compliance with the IDSA guidelines. Secondary objectives were to assess time to first antibiotic and other antimicrobial use parameters (i.e. appropriate antimicrobial initial therapy, escalation, de-escalation, and duration). An algorithm was developed which included recommendations for appropriate antimicrobial use in cancer patients with neutropenic fever. Practitioners were educated and provided with the algorithm. The algorithm was implemented January 1, 2012.

**Results:** Fifty patients were evaluated during this study. Of those 50 patients, 25 were evaluated prior to implementation of the algorithm and 25 were evaluated post-algorithm implementation. The median age was 55 years. Fifty-four percent of the patients were male. Eighty-eight percent had hematologic malignancies, while twelve percent had solid tumors. All patients except one developed febrile neutropenia as a result of a recent chemotherapy. Overall, compliance with IDSA guidelines was improved. All secondary outcome assessments were improved.

**Conclusion:** The use of an antibiotic algorithm for febrile neutropenia improved practitioner compliance with the IDSA recommendations for the management of cancer patients with febrile neutropenia. Time to first antibiotic was improved post-algorithm implementation. Appropriateness of antimicrobial initial selection, escalation, de-escalation, and duration was improved post-algorithm implementation. Improving compliance with IDSA guidelines will improve patient outcomes and decrease microbial resistance.

3-171

**Category:** Oncology

**Title:** Identifying medical oncology patients at high-risk for venous thromboembolism in the outpatient setting

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**Purpose:** The American Society of Clinical Oncology (ASCO) in association with the National Comprehensive Cancer Network (NCCN) currently do not recommend routine thromboprophylaxis in cancer outpatients actively receiving chemotherapy. This recommendation is based on the knowledge that there is a higher incidence of bleeding complications in addition to limited outpatient data on the safe and effective use of prophylaxis in this population. Despite these recommendations, however, Khorana et al. were able to derive a risk model that successfully identified outpatient cancer individuals who were at high risk for the development of a venous thromboembolism (VTE). Thus, the purpose of this study is to determine if Khorana's risk model is applicable specifically to our facility's outpatient oncology population who are actively undergoing chemotherapy.

**Methods:** The institutional review board approved this five-year retrospective analysis of newly diagnosed cancer patients undergoing their first cycle of chemotherapy at our oncology clinic between January 1, 2006 and December 31, 2010. Patients were included if they were 18 years of age and older, had a new cancer diagnosis as discussed in Khorana's study, and received their first cycle of chemotherapy at this institution's outpatient oncology clinic within our designated study period. Patients were excluded if they did not have baseline laboratory values collected within two weeks of starting chemotherapy, had their treatment initiated at an outside facility, or were lost to follow-up within three months of starting their chemotherapy. Each patient was stratified according to Khorana's VTE risk model and those patients who developed a VTE within three months of chemotherapy initiation were identified.

**Results:** Seventy-one patients met inclusion criteria, with an average age of 69 years old (range: 50-90 years old). Seven patients (10%) were classified as low risk, forty-six (65%) were intermediate risk, and 18 (25%) were high risk for VTE development according to Khorana's risk model. Of the seventy-one patients analyzed, three patients developed a VTE within three months of starting chemotherapy. Two patients developed a deep vein thrombosis (DVT) and one patient developed a pulmonary embolism (PE). All three patients were considered intermediate risk according to Khorana's model.

**Conclusion:** With this small sample size, we were unable to conclude that Khorana's risk model would identify those outpatient oncology patients at highest risk for the development of VTE at our facility.

**Category:** Oncology

**Title:** Evaluation of carboplatin dosing methods in pediatric patients undergoing autologous stem cell transplantation

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**Purpose:** In adult cancer patients, renal function-based carboplatin dosing, namely, the Calvert formula is widely used. The modified Calvert formula that can be used in pediatric patients was developed. However, the formula has not been used generally for pediatric patients in Korea. The purpose of the current study was to evaluate the accuracy of the body surface area(BSA)-based dosing method and validate the necessity of the renal function based-dosing by modified Calvert formula in pediatric oncology area.

**Methods:** Twenty-four pediatric patients with solid malignancies were included in this study. Carboplatin was administered according to BSA-based dosing (400 mg/m<sup>2</sup>/day or 500 mg/m<sup>2</sup>/day) for three days as high-dose chemotherapy with autologous stem cell rescue. The carboplatin AUC was calculated for actual carboplatin dose, patients baseline GFR, body weight by rearranging the modified Calvert formula. The modified Calvert formula is: Carboplatin dose (mg) = Target AUC (mgmL-1min) x [GFR (mL/min) + 0.36 x body weight (kg)]. The GFR was measured by the 51Cr-EDTA clearance test. We retrospectively reviewed patients medical chart for 3 months after transplantation and graded toxicities using National Cancer Institute Common Toxicity Criteria Version 4.

**Results:** Based on the baseline GFR, the mean value of calculated AUC on Day 1 was 6.1 mgmL-1min (range: 4.1~9.0) in the total cases of 24 patients. Of these, only 10 patients had daily GFR values for 3 days. In 2 patients, whose mean AUC values for 3 consecutive days were higher than 7mgmL-1min, tubulopathy occurred in one, veno-occlusive disease and Pneumocystis jiroveci pneumonia in the other one. The latter died on day 12 after autologous stem cell rescue.

**Conclusion:** Our study showed that using BSA-based dosing in pediatric patients results in the significant variation of the calculated AUC among individuals. Higher carboplatin AUC was related to higher incidence of toxicities. Therefore, to maintain adequate AUC in children, the use of renal function-based dosing method should be considered. Prospective studies will be necessary to identify the target carboplatin AUC for optimizing outcome and minimizing toxicity in the Korean pediatric autologous transplantation setting.

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**Category:** Oncology

**Title:** Analysis of prescription errors through careful review on chemotherapy regimen

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**Purpose:** This study was about prescription errors detected by pharmacists through the careful review on chemotherapy regimens. It analyzed the content of prescription errors on the chemotherapy for hospitalized patients and looked for practical ways of preventing the errors that could occur in the future.

**Methods:** The study had been done at pharmacy of IV medication in VHS medical center during the six-month period from September 2011 to February 2012. We analyzed 616 chemotherapy regimens of admitted patients for the total number of prescription error, the contents of error such as miscalculated BSA(body surface area), incorrect final concentration, incorrect dosage, incorrect duration, omission of dilution fluids, omission of types of dilution fluid, incorrect changes in strength of chemotherapy medication and omission of reconstitution fluid for powder-form chemotherapy medication.

**Results:** For the 6-month study period there were 616 chemotherapy regimens and 1,631 chemotherapy drug preparations. There were 139 chemotherapy regimen errors(22.6%). The top four factors were as follows; 35 dosage error(18.9%), 34 incorrect final concentration error(18.4%), 32 reconstitution fluid omissions(17.3%), and 26 incorrect changes in chemotherapy drug strength(14.1%). In these dosage error, there were 9 prescription errors due to miscalculated BSA(25.7%), 9 cases of carboplatin(25.7%) related errors that required kidney function test for correct dosage. Other errors were 5 cases of fluorouracil(14.3%), and 2 cases of etoposide(5.7%). All prescription errors detected by pharmacists was corrected and then prepared.

**Conclusion:** This study clearly showed that the careful review on chemotherapy regimen by pharmacists was highly effective and directly connected to the patient's safety. If we could develop computerized chemotherapy regimen system instead of a written one, it would prevent prescription errors in advance. In addition, pharmacists could provide patients better quality healthcare service through sharing valuable information that reviews new chemotherapy medication with other health care providers.

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**Category:** Oncology

**Title:** The use of glucarpidase as adjunctive treatment for a patient with delayed methotrexate elimination

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**Purpose:** The use of high-dose methotrexate (HDMTX) has increased in the treatment of cancer patients, resulting in greater recognition of toxicity and serious life-threatening complications of therapy. Methotrexate (MTX) is almost exclusively cleared through the kidneys, and prolonged elevation of systemic MTX concentrations due to delayed elimination is associated with poor clinical outcomes, including death. Glucarpidase is an enzyme produced in *Escherichia Coli* that hydrolyzes the carboxyl terminal glutamate from folic acid and its analogues, including MTX, resulting in inactive metabolites. The purpose of this report is to describe our experience obtaining and using glucarpidase for management of a patient with delayed MTX elimination, thereby preventing the risk of MTX toxicity.

**Methods:** Compassionate use of glucarpidase was acquired for a 56-year-old female with Non-Hodgkin's Lymphoma whose treatment resulted in delayed MTX elimination following HDMTX. Urgent approval was obtained from the investigational review board for use of glucarpidase under the drug manufacturer's open-label treatment protocol. After providing informed consent, the patient received a single bolus dose of glucarpidase 3,000 units (50 units/kg) intravenously, in conjunction with intravenous leucovorin 150 mg every 3 hours and concomitant urinary alkalinization with oral and intravenous sodium bicarbonate. Prior to drug administration, blood samples were obtained, as required by the manufacturer, for analysis of anti-glucarpidase antibodies.

**Results:** Following administration of glucarpidase, the MTX level decreased by 53%, from 0.30 micromol/L eleven days after HDMTX to 0.14 micromol/L 24 hours after administration of the study drug. Intravenous leucovorin was continued after administration of glucarpidase, with a reduction in the dose from a maximum of 150 mg every 3 hours to 25 mg every 6 hours. The 48-hour and 72-hour MTX levels following glucarpidase administration were 0.05 micromol/L and 0.03 micromol/L, respectively. The patient denied any adverse effects previously reported with glucarpidase.

**Conclusion:** Glucarpidase served as a safe and effective adjunctive treatment for this patient at risk of MTX toxicity. Its use was beneficial by rapidly reducing MTX serum concentrations and subsequently preventing further toxicity. Further experience in a larger population is required to

determine if other patients will have a similar significant response to treatment; however, it provides a viable option for patients with delayed MTX elimination.

3-176

**Category:** Oncology

**Title:** Significant cisplatin toxicity in a patient with testicular seminoma with retroperitoneal metastases

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**Purpose:** Cisplatin is a commonly used chemotherapeutic agent and remains a standard component in the treatment regimens of numerous solid malignancies, including ovarian, bladder, lung, head and neck and testicular cancer. While cisplatin provides numerous anti-tumor properties, there are also several toxic effects associated with its administration including myelosuppression, nausea/vomiting, neuropathies, ototoxicity and nephrotoxicity. This institutional review board approved case report reviews the events of a 42-year-old male patient (height 183 cm, weight 79.8 kg, body surface area 2.01 m<sup>2</sup>) that had been recently diagnosed with testicular seminoma (s/p orchiectomy) with metastases to retroperitoneal lymph nodes and started on a chemotherapy regimen that included bleomycin, cisplatin and etoposide. The patient presented to the hospital after having received two doses of 200 mg/m<sup>2</sup>/day (intended dose: 20 mg/m<sup>2</sup>/day) of cisplatin from an outpatient facility and developed nausea/vomiting, ototoxicity with mild hearing loss and abdominal pain. Upon admission, the patient was noted to be in acute liver injury (aspartate aminotransferase/ alanine aminotransferase (AST/ALT) 849 and 846 units/L, respectively) and acute kidney injury (creatinine 3.70 mg/dL). The poison control center was contacted and recommendations made to begin plasmapheresis, hemodialysis, N-acetylcysteine, sodium thiosulfate and amifostine. Although on admission the patients white blood cell (WBC 10.4 x 10<sup>9</sup>/L) and platelet (132 x 10<sup>9</sup>/L) counts had not yet demonstrated signs of neutropenia, within five days of admission the patient was placed into neutropenic precautions secondary to a significant drop in white blood cell count to 0.3 x 10<sup>9</sup>/L, platelet count to 8 x 10<sup>9</sup>/L and absolute neutrophil count 0.2 x 10<sup>9</sup>/L. The patient developed alveolar hemorrhage and hemoptysis requiring endotracheal intubation that subsequently resolved days later allowing for extubation. Although blood, sputum and urine cultures did not yield any pathogens, the patient was placed on broad spectrum antibiotic, antiviral and antifungal agents secondary to recommendations from the Infectious disease specialist. Serum platinum levels were obtained every four days from admission to monitor the efficacy of plasmapheresis and to assist with guidance of further treatment. These levels ranged from 1800 mcg/L on admission to 210 mcg/L before discharge. As the patients hospital course progressed from his stay in the intensive care unit to the floor service, the patient continued to receive plasmapheresis and hemodialysis secondary to elevated platinum levels and serum creatinine. His hospital course was also significant for abdominal pain, in which a cat scan demonstrated bowel wall edema and colitis,

cholestasis and new onset hypertension; all of which were treated as appropriate. Due to a significant decrease in white blood cell, hemoglobin/hematocrit, and platelet counts the patient received numerous transfusions of packed red blood cells and platelets and was subsequently started on filgrastim and epoetin alfa. While not common in the literature, toxicity with cisplatin can be quite detrimental and can progress to fatal outcomes. This case demonstrates a patient that received two doses of a ten-fold overdose of cisplatin, developed pancytopenia, acute renal failure, acute ototoxicity with complete hearing loss, acute hepatic injury, alveolar hemorrhage with hemoptysis and abdominal pain and was subsequently discharged from the hospital on outpatient plasmapheresis and hemodialysis.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

**Category:** Oncology

**Title:** Pharmacogenetic biomarkers for predisposition to toxicity with irinotecan or oxaliplatin-containing regimens in colorectal cancer patients

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**Purpose:** Chemotherapeutic regimens containing 5-fluorouracil, leucovorin and oxaliplatin (FOLFOX) or irinotecan (FOLFIRI), and capecitabine and oxaliplatin (XELOX) or irinotecan (XELIRI) are the most common first-line treatments for metastatic colorectal cancer (CRC). This combination of drugs has improved prognosis of the disease, however, toxicity is also increased. The purpose of this study was to analyze associations between severe adverse reactions to oxaliplatin or irinotecan-containing regimens and polymorphisms in genes of related metabolic pathways.

**Methods:** Retrospective study with 162 CRC patients treated with oxaliplatin (106 patients) or irinotecan-containing regimens (56 patients). The study was approved by the Regional Ethics Committee for Clinical Research and all patients signed an informed consent for the pharmacogenetic study. The following genotypes were determined: XRCC1 (rs25487), ERCC2 (rs13181), ERCC1 (rs11615), GSTP1 (rs1695), GSTT1 (copy number variation), EGFR (rs4559542), UGT1A1 (rs8175347 and rs10929302) and ABCB1 (rs1128503, rs2032582 and rs1045642). Clinical data (age, sex, treatment and toxicity) and genotype of the selected single nucleotide polymorphisms (SNPs) or copy number variant (CNV) were registered. Toxicity grade greater or equal to 3 was considered severe (except for hand-foot syndrome, greater or equal to 2), based on the Common Terminology Criteria for Adverse Events (CTCAE). Linear by linear association chi-square test (SPSS v.18.0.) was used to study associations between polymorphisms and severe toxicity. A multivariate analysis including sex and performance status was also conducted.  $p < 0.05$  was considered significant.

**Results:** Mean age of patients included in the study was 64 years and 58.6% were male. In the univariate analysis statistically significant associations were obtained between the polymorphism in ERCC2 and diarrhea and gastrointestinal toxicity; ERCC1 and mucositis; ABCB1 (rs1128503) and hand-foot syndrome, asthenia and other toxicities; ABCB1 (rs2032582) and asthenia; ABCB1 (rs1045642) and diarrhea; and GSTT1 and asthenia. In the multivariate analysis statistically significant associations were obtained in patients treated with an irinotecan-containing regime between rs1128503 (ABCB1 1236) and CNV of GSTT1 with asthenia (CC vs.

CT/TT: OR, 0.043; 95%CI, 0.004-0.444; p=0.008 and OR, 0.046; 95%CI, 0.003-0.684; p=0.025, respectively), rs1045642 (ABCB1 3435) with diarrhea (CC vs. CT/TT: OR, 0.162; 95%CI, 0.031-0.844; p=0.031) and rs1128503 (ABCB1 1236) with other toxicities (CC vs. CT/TT: OR, 0.182; 95%CI, 0.045-0.742; p=0.017). In the sample of patients treated with oxaliplatin-containing regimes only the association between rs11615 (ERCC1) with neutropenia was confirmed (CC vs. CT/TT: OR, 0.203; 95%CI, 0.060-0.683; p=0.010).

**Conclusion:** These results could help oncologists reduce adverse reactions associated to irinotecan and oxaliplatin-containing regimes by giving patients the best possible option. The potential clinical applications and the possible benefits to therapy prescribed by oncologists to CRC patients could improve patients quality of life. Bigger cohorts are needed to verify the associations obtained between the polymorphisms in ERCC2, ERCC1, ABCB1 and CNV in GSTT1 and the development of toxicity.

**Category:** Oncology

**Title:** Concentration-dependent venous irritation induced by bendamustine injection

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**Purpose:** Bendamustine (BM) is used for patients with follicular lymphoma or mantle cell lymphoma with or without rituximab in Japan. However, its intravenous injection sometimes causes venous irritation such as erythema, injection site pain and phlebitis. BM is marketed in many countries and it is recommended to dilute in the final volume of 500 mL at the concentration of 0.2-0.6 mg/mL in most countries including the US. In Japan, however, it is described in the product package insert that the final volume of BM should be set for 250 mL. The incidences of BM-induced venous irritation at approval were reported 30.8% in Japan but less than 10% in the US. This difference might be important in the occurrence of venous irritation. However, the correlation between the final concentration of BM diluent and the incidence of venous irritation has been unclear. In the present study, we analyzed the risk factors associated with venous irritation induced by BM. We also evaluated the effectiveness of intervention of changing the preparation procedure for BM we proposed to the Cancer Chemotherapy Review Committee.

**Methods:** The subjects were 21 patients who received totally 58 courses of BM from December 2010 to November 2011. Initially, BM (120 or 90 mg/m<sup>2</sup>) was diluted in the final volume of 250 mL of normal saline in most cases. All data were retrospectively collected from the nursing records and the electronic medical charts. Venous irritation was assessed by existence of infusion site pain, swelling and redness using the medical record system. Based on the initial results of 43 courses, we changed the preparation procedure into that used in the US. After the intervention, the data of 15 courses were collected. The difference of frequency of venous irritation was analyzed by Fishers exact test. The univariate analysis was conducted to identify the risk factors for the BM-induced venous irritation.

**Results:** By the intervention, the percentage of use of 250 mL of BM diluent was significantly decreased from 88% to 20% ( $P<0.001$ ), and the incidence of venous irritation was significantly decreased from 58% to 20% ( $P=0.016$ ). The frequency of venous irritation was significantly lower when the final volume was 500 mL than 250 mL (6% vs 66%,  $P<0.001$ ). The concentration of BM diluent was more than 0.4 mg/mL, when the final volume was 250 mL. The incidences of venous irritation were 6% (1/17), 62% (18/29) and 75% (9/12), when the

concentrations of BM were 0.40 mg/mL, 0.41-0.60 mg/mL and >0.60 mg/mL, respectively. There was not significant risk factor other than the final volume and the concentration of BM.

**Conclusion:** The high concentration of BM solution is a risk factor for venous irritation and 500 mL of diluent is reasonable. To further reduce the incidence of venous irritation, its concentration is recommended to be 0.40 mg/mL or less.

3-179

**Category:** Oncology

**Title:** Effect of an oncology pharmacy elective course on fostering interest in oncology pharmacy as a career specialty

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**Purpose:** To compare the level of student interest in a career in oncology pharmacy before and after participating in an elective oncology pharmacy course.

**Methods:** Doctor of Pharmacy students enrolled in an oncology pharmacy elective course were given an anonymous written survey of 10 questions on the first day of class and then after completing the final exam. The first four questions of the survey were used to gauge the students existing level of understanding of oncology pharmacy and experience working in a pharmacy. These questions were only asked the first time the survey was given. The last six questions were asked at the beginning and end of the course and asked students to rate their familiarity with the activities of an oncology pharmacist and their level of interest in working as an oncology pharmacist, completing an oncology specialty residency, and achieving Board of Pharmaceutical Specialties certification in oncology pharmacy. This study was approved by the Colleges institutional review board.

**Results:** Sixteen of 24 students (60%) completed the first phase of the survey, while all 24 students (100%) completed the second phase. While 75% of students had experience working as a technician/intern in a pharmacy, only 3/13 (19%) had prepared intravenous chemotherapy and 5/16 (31%) had prepared an oral chemotherapy medication for dispensing. Before the course started, only 2/16 (13%) of students felt they had some familiarity with the activities of an oncology pharmacist, 5/16 (31%) considered themselves familiar with chemotherapy drugs, and 3/13 (19%) familiar with managing side effects of chemotherapy. The familiarity of each of these areas increased to 23/24 (96%) upon completion of the course. The interest in becoming an oncology pharmacist, completing an oncology pharmacy specialty residency, and earning board certification in oncology decreased from pre to post course completion in all three categories from 12/16 (75%) to 17/24 (71%), 8/16 (50%) to 11/24 (46%), and 10/16 (62%) to 12/22 (55%), respectively.

**Conclusion:** Although the course improved student understanding of the activities of an oncology pharmacist, it may also have steered some students away from selecting oncology as a clinical specialty. Opportunities in academia should be available to help students become familiar with clinical pharmacy specialties that are available to them and assist in selecting their career path.

**Category:** Oncology

**Title:** Knowledge of cancer screening recommendations among health fair attendees

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**Purpose:** Routine cancer screening is an important means of early detection of malignancy. Data reported by the American Cancer Society (ACS) reveals that many patients do not participate in recommended screening programs. The purpose of this study was to examine the knowledge of cancer screening recommendations in a population of health fair attendees.

**Methods:** Written surveys were administered to participants at local health fairs in New Hampshire. The survey included demographic questions, questions about personal and family history of cancer, as well as questions regarding level and frequency of worry about getting cancer. Participants were also asked a series of gender specific questions regarding the recommended frequency of cancer screening and the degree to which they adhere to these recommendations. Answers were compared to the 2011 ACS screening recommendations for accuracy. Study methods were approved by the Schools institutional review board. Statistical analyses were conducted using JMP software and p-values less than or equal to 0.05 were considered statistically significant.

**Results:** There were 101 participants-33 male, 68 female. Most participants were Caucasian (97%) and between 45 and 65 years of age (42%). The majority of participants had a family history of cancer (68%), while 18% had a personal history of cancer. The majority of participants correctly recognized the recommended frequency of screening tests for colon cancer (57%), prostate cancer (53%), breast cancer (79%), and cervical cancer (74%). The ability to correctly identify screening recommendations was influenced by a personal history of cancer in all cases, except with regard to cervical cancer screening. Women with a history of cancer were 1.37 times more likely to correctly identify the screening recommendations for breast cancer compared to women with no history (95% CI, 1.16-1.61, p equals 0.024). Men with a history of cancer were twice as likely to correctly identify the screening recommendations for prostate cancer compared to men with no history (95% CI, 1.42-3.02, p equals 0.044). Men and women with a history of cancer were 1.65 times more likely to correctly identify the screening recommendations for colon cancer compared to participants with no cancer history (95% CI, 1.21-2.22, p equals 0.012). The percentage of correct answers was not influenced by gender, age, family history of cancer, perceived risk of cancer, or frequency of worry about getting cancer.

**Conclusion:** Health fair attendees were knowledgeable about ACS cancer screening recommendations. The frequency of choosing the correct screening recommendation was higher in participants with a personal history of cancer.

**Category:** Oncology

**Title:** Knowledge of healthy habits in cancer prevention among health fair attendees

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**Purpose:** A healthy lifestyle and avoidance of known carcinogens are important in the prevention of cancer. The purpose of this study was to determine the knowledge of healthy lifestyle choices in cancer prevention among health fair attendees.

**Methods:** A survey was administered to participants at two local health fairs in New Hampshire. The survey included demographic questions, questions about personal and family history of cancer, and asked participants to rate the importance of lifestyle measures on reducing their personal risk of cancer. Participants were asked to rank each of the following measures on a scale of 1 to 5 (1 equals very important, 5 equals unimportant): avoiding cigarettes, maintaining a healthy body weight, regular physical activity, having a diet rich in fruits and vegetables, limiting alcohol intake, protecting the skin from the sun, and having regular checkups and screenings. The survey was approved by the School's institutional review board. Statistical analyses were conducted using JMP software and p values less than or equal to 0.05 were considered statistically significant.

**Results:** A total of 101 participants (67% female) completed the survey. The majority of participants were between ages 45 and 65 years (42%) and 97% were Caucasian. Sixty-three percent had a family history of cancer, and 18% had a personal history of cancer. Eighty-three percent reported that receiving regular checkups and screenings are very important or important in preventing cancer. The majority also reported that avoiding cigarettes/tobacco (88%), participating in regular physical activity (77%), eating a healthy diet rich in fruits and vegetables (79%), maintaining a healthy weight (83%), and protecting the skin from the sun (82%) are very important or important in preventing cancer. Sixty-three percent of participants reported that limiting alcohol intake is very important or important in cancer prevention, and 31% reported that it is only moderately important. More participants with a personal history of cancer (89%) reported that limiting alcohol intake is very important or important in preventing cancer compared to 57% without a personal history of cancer ( $p$  equals 0.048). There were no other statistical differences found among participants with a personal or family history of cancer or between men and women.

**Conclusion:** Health fair attendees had a good knowledge of the role of lifestyle factors in cancer prevention. There was little impact of personal or family history on responses, except with regard to the importance of limiting alcohol, and no influence of gender on responses. Despite having adequate knowledge, it is unclear if participants adhere to healthy habit recommendations.

3-182

**Category:** Oncology

**Title:** Hybrid-dosing ondansetron vs. standard palonosetron in the treatment of chemotherapy-induced nausea and vomiting - a retrospective review

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**Purpose:** 5-HT<sub>3</sub> Antagonists (5-HT<sub>3</sub>A) like ondansetron and palonosetron are used in the prevention of chemotherapy-induced nausea and vomiting (CINV). Comparative studies have often not been designed to account for the distinct pharmacokinetic profiles of these agents; in most cases a single dose of palonosetron has been compared with a single dose of the shorter-acting ondansetron (half-lives 40 hours vs. 3 to 6 hours, respectively). Taking into consideration both the pharmacokinetic profile and FDA-approved dosing of ondansetron, a novel hybrid-dosing regimen of ondansetron was implemented in our oncology medical group: 16mg intravenous (IV) administered at the clinic 30-minutes prior to chemotherapy administration on Day 1, followed by 8mg orally every 12 hours for 3-5 days post chemotherapy. To protect for any potentially delayed emesis, patients are instructed to take oral ondansetron for 3 to 5 days. The purpose of this retrospective study was to 1) evaluate the differences between the novel hybrid-dosing protocol of ondansetron vs. a single dose of palonosetron in preventing both acute and delayed CINV in the ambulatory oncology setting; 2) evaluate the differences in the occurrence of constipation, a potential adverse effect of this drug class; and 3) calculate the financial impact that resulted from implementation of this protocol change.

**Methods:** This was a retrospective observational cohort study of cancer patients from four ambulatory infusion service sites of the Palo Alto Medical Foundation. Patients were included if they received chemotherapy and either single dose palonosetron or hybrid dosing of ondansetron. The time period studied was from July 2010 to April 2011. Approval was granted and data were captured from the electronic medical records for those patients meeting inclusion criteria. Notes in patient medical records and ICD-9 codes were screened for episodes of nausea and vomiting (N/V) within 5 days of chemotherapy infusion, as well as any complaints of constipation or diarrhea. Data were further stratified by the emetogenicity of the chemotherapy regimen. Cost savings of the protocol change were evaluated by an independent auditor.

**Results:** We identified 882 unique patients undergoing a total of 1,184 chemotherapeutic regimens, with 598 patients receiving ondansetron and 284 patients receiving palonosetron. Overall, the rate of N/V was 9.70 percent among ondansetron-treated patients and 11.27 percent among palonosetron-treated patients (Treatment difference: -1.57 [95 percent CI:-5.95, 2.81]).

Analysis of the stratified cohorts revealed that while ondansetron-treated patients were slightly less likely to undergo higher emetogenic chemotherapeutic regimens than palonosetron-treated patients, (91.13 percent and 96.13 percent respectively), both groups demonstrated similar rates of N/V (8.07 percent and 10.26 percent, respectively) (Treatment difference: -2.19 [95 percent CI: -6.45, 2.08]). The rate of constipation was 12.88 percent among ondansetron-treated patients and 10.21 percent among palonosetron-treated patients (Treatment difference: 2.67 [95 percent CI:-1.76, 7.09]). Overall, the protocol change was associated with a cost savings of 517,641 dollars over the course of one year.

**Conclusion:** In this sample of patients, hybrid-dosing ondansetron and single-dose palonosetron were associated with similar rates of N/V, with slightly lower rates among hybrid ondansetron-treated patients, even when patients were stratified by emetogenicity of the chemotherapy regimen. Whereas rates of constipation were slightly higher with ondansetron, a significant cost savings was realized. Therefore in our setting, hybrid-dosing ondansetron appears to be clinically equivalent to palonosetron and is associated with lower costs. Limitations to this study include its retrospective, non-experimental design, and post hoc statistical analyses.

**3-183**

**Category:** Oncology

**Title:** An Elective in Advanced Therapeutic Management of Oncology Patients

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**Purpose:** An elective was designed that featured an advanced overview on the therapeutic management of cancer patients. The primary goals for this course included introducing a comprehensive list of oncology-related topics, principles of palliative care, hospice and end of life care with a focus on developing advanced clinical skills and competencies necessary for pharmacists to provide care to this special patient population.

**Methods:** Course activities included assigned readings, class discussions, and student presentations. A survey instrument was developed and administered at the end of the spring 2012 semester to pharmacy students enrolled in the elective course. Seventeen students (100%) completed the voluntary, anonymous, course evaluation.

**Results:** Student course evaluation results indicated that students were satisfied with the course topics, format, and activities. All of the students surveyed indicated they would recommend this course to future pharmacy students.

**Conclusion:** An elective course in oncology and palliative care was well received by PharmD students. This elective course enhances the quality of our pharmacy school curriculum, and meets the 2007 ACPE accreditation standards provision of pain management and palliative care.

**3-184**

**Category:** Oncology

**Title:** Electronic medical record messaging can change clinical practice and lead to reduction in the use of granulocyte-colony stimulating factor without compromising quality care.

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**Purpose:** Granulocyte-colony stimulating factor (G-CSF) is commonly used to maintain chemotherapy dose intensity in the treatment of Hodgkins lymphoma (HL). Several studies have documented the safety of treating patients with HL using adriamycin, bleomycin, vincristine, and doxorubicin (ABVD) without the routine use of G-CSF, yet growth factors are routinely used to maintain dose intensity. The National Comprehensive Cancer Network (NCCN) guidelines in HL currently do not recommend the routine use of G-CSF and suggest that leucopenia is not a factor for delay of treatment or reduction of dose intensity. The purpose of this retrospective review was to determine if therapeutic messaging embedded in the electronic medical record could change practice and safely reduce or eliminate the use of G-CSF without compromising quality care.

**Methods:** In July of 2011, lab parameters in the ABVD protocol were updated to eliminate minimum neutrophil counts necessary to receive chemotherapy. Concurrently, therapeutic messaging was embedded within the electronic medical record stating that patients may be treated at full dose without growth factor, on time, regardless of hematologic counts. Links to further information or references were also included in the therapeutic messaging. By removing minimum treatment parameters and adding therapeutic messaging, clinicians would be more aggressive in their decision making to maintain dose intensity rather than delay treatment or reduce chemotherapy dose. A retrospective chart review was completed. All HL patients greater than or equal to 18 years of age treated with ABVD with curative intent between October 2009 and April 2012 were included. Patient charts were reviewed to determine the use of G-CSF, chemotherapy dose intensity, and documentation of febrile of neutropenia.

**Results:** There was a 41% reduction in the number of patients treated with G-CSF and an 11% reduction in episodes of febrile neutropenia since therapeutic messaging was embedded within the electronic medical record. There was a 29% increase in the number of patients who maintained full dose intensity.

**Conclusion:** Therapeutic messaging embedded within the electronic medical record successfully reduced the use of G-CSF and improved the number of patients who maintained dose intensity without compromising patient safety.

**3-185**

**Category:** Operating Room Pharmacy

**Title:** Development of a clinical operating room surgical rotation

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**Purpose:** A safety consensus document by The Anesthesia Patient Safety Foundation and practice guidelines published by the American Society of Health System Pharmacists (ASHP) recommend inclusion of a clinical pharmacist in the operating room (O.R.). Pharmacy surgical rotations at our institution previously focused only on training for postoperative care of surgical patients. The authors describe a specialty clerkship rotation that introduces students to the O.R. and some of the unique therapies there-in.

**Methods:** Students spend their full rotation focused on intraoperative care of the surgical patient. Medication management, observation and topic research are major components of the rotation. Students are exposed to a high volume practice of approximately 340 surgical cases daily. The wide variety of specialties at our tertiary care facility maximizes opportunity and allows tailoring the rotation to the trainees interest.

**Results:** Students find that the once intimidating environment of the O.R offers a new dimension to their experiences and education. Topics that may have only been briefly mentioned in their didactic training are now more thoroughly presented to the students. Based on the interest generated by the clerkship rotation, we plan to extend the opportunity to our ASHP residents in the near future.

**Conclusion:** We are fortunate to be part of a large medical institution that encompasses a wide variety of surgeries coupled with unique, rare disease states. Interventions by clinical pharmacists are frequent in this arena. Student interaction with our O.R. pharmacy staff and preceptors offers experiences that are not available in other rotations at our institution.

**3-186**

**Category:** Operating Room Pharmacy

**Title:** Detection of narcotic diversion using an audit review of anesthesia records

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**Purpose:** To determine if analysis of intraoperative electronic medical records by cpt(current procedural terminology) code, anesthetist, and other variables can serve to identify cases with controlled substance diversion.

**Methods:** All anesthetic records contained in the electronic medical record from 7/1/2011 till 3/15/2012 were analyzed for surgical cases designated by specific cpt codes to review controlled substance use. Only surgical cases with a CPT code consisting of at least 35 cases were included. Variables included opioid dose, propofol dose, patient weight, surgical time, cpt code, and anesthetist. Average utilization for these drugs within cpt codes was calculated. Control chart analysis and graphing provide an objective means of review. Cases where utilization exceeded defined limits were reviewed for potential narcotic diversion. An anesthetist with a single controlled substance use beyond two standard deviations or use beyond one standard deviation for three cases within a cpt code identified an anesthetist to be reviewed for potential diversion.

**Results:** Over thirteen thousand case records involving one hundred and fifty cpt codes met inclusion criteria. Average drug use for opioids and propofol were established for these CPT codes using control chart methodology. No cases of diversion were identified in this dataset. However, this methodology was validated with cases by two providers known to have diverted.

**Conclusion:** Electronic medical record review allows for an objective and efficient method of controlled substance auditing using control chart methodology. CPT code grouping provide a common population for establishment of average drug utilization and thus a yardstick for recognizing a statistical variation indicating potential diversion.

3-187

**Category:** Operating Room Pharmacy

**Title:** Performance analysis of automated anesthesia dispensing system

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**Purpose:** Anesthesia medications are a high cost component in surgical procedures representing about eight percent of the total pharmacy budget. Traditional anesthesia medication trays pose challenges to optimize charge capture and inventory management. For optimal reimbursement of the anesthesia services, the billing must be completed and submitted in a timely manner. The pharmacy implemented an automated anesthesia dispensing system to improve billing accuracy and inventory control. The objective of this study is to assess the accuracy of billing, charge capture and the elements of medication safety in an automated anesthesia dispensing system.

**Methods:** For pre-implementation data, a prospective reconciliation of the medication charge sheets and anesthesia administration records was conducted over a five-day period. The data collection involved the comparison of documented medication administration on the anesthesia records against the medication charge sheets for accurate charge capture and any medication related variances. During the implementation of the automated anesthesia dispensing system, the layouts of current anesthesia medication trays were reviewed to streamline inventory control. A multidisciplinary team was formed consisting of representatives from the pharmacy department, anesthesiologists, and nurse anesthetists. In collaboration, the anesthesia medication drawers were standardized for all operating rooms with certain add-on medications restricted for areas providing vascular, heart surgery, labor and delivery, gastrointestinal lab, and special procedures. For post-implementation data, the revenue reports were extracted from the electronic billing system to compare the rate of charge capture. The automation reports were reviewed to establish benchmarks for measuring the system performance.

**Results:** The analysis of 324 (79.8%) cases indicated a loss greater than \$6,570 charges during the five-day study period which could represent about 39.6% (\$427,062) of annual anesthesia medication purchase. About 15 percent (n=47) of the charge sheets showed the medications charged without documented administration in the medical record. The remaining 20 percent (n=82/406) of charge sheets were not available for review during the study. Thirty-seven automated anesthesia dispensing cabinets were fully implemented in all operating rooms and procedural areas. There was a cost saving of \$11,500 through the reduction of duplicate anesthesia trays for replenishment. The implementation of automated anesthesia dispensing system improved the billing performance and the quality of pharmacy services. The automated system provided a real-time data to manage inventory through an electronic interface to measure utilization, stock-outs, and the pharmacy workload. The elimination of anesthesia medication

trays freed pharmacy and anesthesia staff from unnecessary tasks for better quality of patient care.

**Conclusion:** Traditional anesthesia medication trays were associated with a loss of charge capture and limited inventory control by the pharmacy. The implementation of automated anesthesia dispensing systems improved billing performance and charge capture in the operating rooms. The standardization of anesthesia medications provided the pharmacy with higher level of transparency into inventory control. The technology served as an enhancement tool for efficient workflow and safe anesthesia medication management.

**Category:** Pain Management

**Title:** Characterization of chronic opioid monitoring practices using urine and serum drug testing at the VA Maryland Health Care System (VAMHCS)

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**Purpose:** Over the last decade outpatient prescriptions for opioid medications at the VAMHCS has more than doubled from 17,096 in 2000 to 35,588 prescriptions in the year 2010. The safety of patients receiving these medications is a primary concern. Tools to monitor opioid therapy at the VAMHCS include pain contracts, urine drugs of abuse testing (DAT), gas chromatography mass spectrometry (GCMS), and serum drug levels. These tests may be underutilized or misinterpreted in current practice which could jeopardize patient safety. The purpose of this study was to characterize the use of these monitoring practices to determine appropriate utilization and interpretation in primary care patients receiving morphine and oxycodone for chronic non-malignant pain.

**Methods:** The institutional review board approved this retrospective chart review of patients within the VAMHCS who received opioid prescriptions in the year 2010 from primary care providers. This study included patients who received at least six monthly outpatient prescriptions for morphine sulfate controlled release or oxycodone in doses greater than or equal to 80 mg per day. All forms of oxycodone available to outpatients at the VAMHCS were eligible for inclusion. Patients were excluded if they received opioid medications prescribed by pain clinic providers or oncology providers. In addition patients who received methadone liquid and patients who received greater than or equal to 28 day supply of hydromorphone, hydrocodone, or codeine were also excluded. Fifty morphine and fifty oxycodone patients who had DATs completed were to be randomly selected for chart review to classify DAT results as normal or abnormal. Provider response to abnormal results and the use of pain medication restrictions and pain contracts were also examined.

**Results:** After assessing patients for enrollment, 117 and 33 were included in the morphine and oxycodone arms respectively. Fifty morphine and 30 oxycodone patients were included for chart review. The percentage of DATs completed was 82 percent in the morphine arm and 91 percent in the oxycodone arm. Fifteen percent of morphine DATs and 47 percent of oxycodone DATs were considered to be abnormal. The most common cause of an abnormal DAT was the absence of opiates in the oxycodone arm (88 percent) and presence of cannabinoids in the morphine arm (41 percent). There was no provider response documented regarding abnormal DATs in 65

percent and 68 percent of morphine and oxycodone DATs respectively. Of the patients included for chart review, 46 percent of morphine and 33 percent of oxycodone patients had pain contracts and 2 patients in each arm had an active pain medication restriction on file. No patients in the morphine arm and less than 15 percent of oxycodone patients had urine GCMS or serum oxycodone testing completed.

**Conclusion:** Results of this research project demonstrated that while providers are monitoring patients with DATs, other available monitoring parameters including serum testing and pain contracts are underutilized. Documentation of provider response to abnormal DATs was found to be variable. Results of this study will be utilized to design and implement an educational program for primary care providers to improve current monitoring practices. These results also underscore the lack of sensitivity of the current DAT for synthetic opioids like oxycodone, and suggests that a more sensitive screening tool for synthetic opioids should be considered.

**Category:** Pain Management

**Title:** Ketamine infusion for loin pain hematuria syndrome exacerbation refractory to opioid therapy: a two-patient case study

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**Purpose:** This case series demonstrates the potential benefit of using ketamine infusion for patients experiencing an acute exacerbation of loin pain hematuria syndrome (LPHS) that is refractory to opioid treatment alone. This study was granted exemption from our local institutional review board, and patient informed consent was not required. Patient 1 is a 22-year-old male with a past medical history significant for LPHS, IgA nephropathy, and nephrolithiasis. Due to his chronic pain secondary to LPHS, he follows with the institutions pain management team for outpatient treatment. His maintenance therapy consisted of scheduled oral methadone and hydromorphone for breakthrough pain. He was admitted for an acute episode of LPHS that was nonresponsive to escalation of oral opioid treatment as an outpatient. A hydromorphone patient-controlled analgesia pump and intravenous lidocaine were started during his hospitalization, but did not provide significant symptomatic relief. Ketamine was then initiated per the institutions established ketamine infusion protocol for pain management, at a dose of 0.1 mg/kg/hr. Treatment allowed a reduction in the patients doses of opioids and discontinuation of lidocaine. The patient was then discharged home with scheduled methadone, mexilitine, hydromorphone for breakthrough pain, and a ketamine nasal spray for recurrent exacerbations. Patient 2 is a 47-year-old female with a past medical history significant for LPHS, nephrolithiasis, and asthma. She had undergone a renal auto-transplantation to manage her LPHS, however, her symptoms persisted. Her pain had since been managed with transdermal fentanyl and oral hydromorphone for breakthrough pain. She experienced an exacerbation that was unresponsive to breakthrough pain management and required hospitalization. Her transdermal fentanyl was discontinued, and she was started on a ketamine infusion at a rate of 0.1 mg/kg/hr and as-needed hydromorphone. The patients symptoms improved, and she was transitioned to scheduled methadone and the ketamine infusion was discontinued. She was then discharged home on scheduled methadone, hydromorphone for breakthrough pain, and a ketamine nasal spray. Both patients continue to follow up with the pain management team, and have been managed successfully as outpatients with their regimens. Loin pain hematuria syndrome is a relatively rare disease that often requires chronic pain management. However, during acute episodes, there is scant literature to support alternative therapy to utilize other than escalation of opioids. The utilization of ketamine infusion for acute episodes of LPHS may be beneficial to help reduce the use of opioids, and help resolve these episodes more promptly. The

mechanism of ketamine benefit may be due to the impact on NMDA receptors, especially when high doses of opioids are utilized. It has also been hypothesized that NMDA receptor subtypes exist in the kidney that may explain its therapeutic benefit. Our cases demonstrate a further need to investigate the utilization of ketamine for patients with acute episodes of LPHS to reduce opioid requirements.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

**3-190**

**Category:** Pain Management

**Title:** Implementation of a pharmacist led pain consult service utilizing electronic order entry in a community hospital

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**Purpose:** The Joint Commission has identified a need for specific standards to improve patient access to proper education, assessment and management of pain. Inappropriately managed pain may also negatively impact patient satisfaction. A pharmacist led pain consult service was implemented utilizing electronic order entry to improve compliance with existing standards and patient satisfaction.

**Methods:** Beginning on April 1, 2011, a Consult Pharmacy order was enabled in the electronic order entry system, available to any healthcare provider with access. Once consulted, a pharmacist conducted a history of current pain issues, assessment of current therapy, adverse event evaluation and discussion of pain control expectations. Pharmacists directly contacted the appropriate prescriber with recommendations for improving pain management. Any accepted recommendations were also communicated to the patient's nurse. Follow-up visits were conducted to ensure continued safety and efficacy of recommendations. Documentation of completed consults was performed within the electronic medical record. Data collection was completed on September 30, 2011. Descriptive statistics or the student's t test were used to analyze the data, where appropriate.

**Results:** A total of 119 pain consults were completed over the 6 month study period. The most frequent interventions included dose titration of current therapy (53 percent), adverse event avoidance or treatment (21 percent), initiation of a new medication (11 percent) and conversion to an alternative agent (7 percent). Patient education was the sole intervention in 24 percent of all consults. Average consult duration was 20 minutes. A comparison of the mean HCAHPS percentile ranks with the 6 months immediately preceding the program demonstrated an increase in pain management scores, though this difference was not statistically significant (35th percentile vs 47th percentile,  $p=0.2$ ).

**Conclusion:** Implementing a pharmacist led pain consult service utilizing electronic order entry resulted in a large number of accepted recommendations and a non significant increase in patient satisfaction with pain management. Larger studies are needed to evaluate the impact of pharmacist consults for pain management on patient satisfaction improvements.

**Category:** Pain Management

**Title:** Patient satisfaction with intravenous acetaminophen treatment: A meta-analysis of randomized, placebo-controlled, repeated dose studies in the acute postoperative setting.

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**Purpose:** The Joint Commission has driven an increased focus on patient satisfaction with study medications and pain management in the hospital setting. As a result, we performed an analysis of patient satisfaction data of a widely used analgesic, intravenous acetaminophen (OFIRMEV, Cadence Pharmaceuticals, Inc, San Diego, CA).

**Methods:** Using the National Library of Medicine (NLM), PubMed search system with the terms patient satisfaction and intravenous acetaminophen, an initial search was performed and 27 studies were identified. The five randomized studies that were included in the meta-analysis were based on the following inclusion criteria: repeated dose administration of intravenous acetaminophen and a validated patient global assessment (PGA) at 24 hours. PGA score (ranging from 0=poor, 1=fair, 2=good, 3=excellent) was the primary endpoint. Patients in both the IV acetaminophen and the placebo groups also received opioid treatment as per the hospitals standard of care. Overall percentages of each categorical response were calculated and a sub-group analysis was performed based on age (<65 years, ≥65 years), gender (male, female), race (White, non-White), surgery type (abdominal/gynecological, hip arthroplasty, knee arthroplasty), baseline pain intensity (VAS <40, 40-70, >70 mm), and incidence of treatment emergent adverse events were also obtained.

**Results:** A total of 717 patients who received repeated doses of intravenous acetaminophen (n=351) or placebo (n=366) had PGAs at 24 hours. Demographics (age, gender, and race) and baseline characteristics such as surgery type and pain intensity (measured by VAS scores) were similar between the intravenous acetaminophen and placebo groups. There was a statistically significant difference ( $p<0.001$ ) in patient satisfaction favoring intravenous acetaminophen 1g compared with placebo. 78.7% of patients who received intravenous acetaminophen rated their satisfaction as excellent or good versus 62.8% of patients who received placebo. Additionally, intravenous acetaminophen showed better satisfaction independent of age, gender and presence of treatment emergent adverse events ( $p<0.001$ ). Patients who were White, underwent abdominal, gynecological surgery or hip arthroplasty, and had moderate or severe baseline pain intensity ( $p<0.001$ ) also favored intravenous acetaminophen.

**Conclusion:** : Results obtained from this meta-analysis of patient satisfaction showed that more than 75% of patients who received IV acetaminophen rated their treatment as excellent or good. The overall data from our analysis, in addition to the literature review, suggested that intravenous acetaminophen conferred a high degree of patient satisfaction with their pain control.

**Category:** Pain Management

**Title:** Effect of patient controlled analgesia lockout interval on patient safety and pain control

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**Purpose:** Opioid medications are amongst the highest-risk medications, potentially causing adverse patient events or death. Many hospitalized patients receive opioids, particularly post-operatively. Frequently, opioids are administered intravenously (IV) using patient-controlled analgesia (PCA) pumps to ideally provide appropriate on demand pain relief reduced risk of drug related injury to patients. While PCA devices are designed to mitigate some of the inherent risk of IV opioid administration, use may still be attributed to opioid-related adverse events and mortality. Current consensus recommendations suggest conservative standard initiation orders as best practice to improve patient safety. Opioid nave patients and others with risk factors for respiratory depression may benefit from cautious initial parameters, such as lower doses or increases lockout periods, as doses can be subsequently titrated for effective analgesia. This study evaluates extension of the PCA lockout period, from 6 to 10-minutes, as a safety measure to prevent overdose related to patient demand behavior.

**Methods:** The institutional review board determined this pre- and post-intervention analysis is exempt as the study involves collection of existing data and records collected in a manner where patients are unidentifiable. PCA safety and efficacy in adult patients, 18 or older, admitted to the University of California, San Francisco Medical Center at Parnassus was evaluated in this study. Over a 3-week period, a report of active PCA orders was compiled for patients receiving PCA on the institutions high-use days. A chart review was performed and data were collected over a 3-week interval during the pre- and post-intervention study period. Data were collected for the first 24-hours from initiation if PCA. Researchers collected demographic information, opioid use, risk factors for respiratory depression, pain scores, oxygen saturation and other monitoring parameters for PCA use. Each patient was analyzed once; if patients were listed on the PCA utilization report multiple weeks in a row, they were only included in the analysis when first identified. Patient flow sheets, charts, electronic medical records and the pharmacy order entry system were used to collect data. An intervention involving a change to the PCA order set was initiated, whereby the lockout interval was extended from 6 to 10-minutes.

**Results:** The majority of patients are opioid nave both pre- (65%) and post-intervention (75.5%) and were receiving PCA for post-operative pain control, in 88.9% and 81.6% of patients respectively. Documented adverse events related to opioids were 2.4% pre-intervention and 1% post-intervention; however, no naloxone was administered during the first 24 hours for either group. Many patients had risk factors for respiratory depression, including chronic obstructive

pulmonary disease (COPD), obstructive sleep apnea, or obesity. However, obesity was the most common risk factor for both groups pre- (31.7%) and post-intervention (23.4%). Median pain score 12 hours after initiation of PCA was 4 on a 1-10 scale for both cohorts.

**Conclusion:** Increasing the lockout interval in the standard PCA orderset from 6 to 10-minutes does not adversely affect patient outcomes. Data showed no decrease in pain control or increase in adverse events reported. The observed trend in adverse event data may suggest a decrease in respiratory adverse events; however, further research is needed to determine significance of this trend. The results from this study suggest extending the lockout interval may improve the safety, and without negatively impacting analgesia in patients receiving PCA, meets best practice recommendations.

**Category:** Pharmacokinetics

**Title:** Pharmacokinetic characterization of extended-release topiramate (USL255) compared to immediate-release topiramate after single- and multiple-dose administration

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**Purpose:** Fluctuations in anti-epileptic drug (AED) plasma concentration may lead to increased side effects or break-through seizures at peak ( $C_{max}$ ) and trough ( $C_{min}$ ) concentration levels, respectively. Compared to immediate-release (IR) formulations, extended-release (ER) AEDs can provide stable plasma concentrations over time with less frequent administration. Upsher-Smith Laboratories, Inc. (USL) is developing USL255, a once-daily (QD) ER formulation of topiramate (TPM), for the treatment of epilepsy. The objective of this abstract is to describe the pharmacokinetic (PK) characteristics of USL255.

**Methods:** USL255 was evaluated in 3 separate Phase 1, randomized, open-label studies in healthy individuals. The first was a single-dose (SD), 5-way crossover study to evaluate dose proportionality and linearity of USL255 (25 to 400 mg) in 30 subjects. Study 2 (N=36) was a SD design with 3 dosing periods (USL255 200 mg QD fed, USL255 200 mg QD fasted, and TPM IR 100 mg administered 12 hours apart [Q12hr] with the first dose in the fasted condition). Finally, a 2-way crossover, multiple-dose study compared the steady-state (SS) PK profiles of USL255 200 mg QD and TPM IR 100 mg Q12hr. Following up-titration, 38 subjects were maintained on 200 mg/day of study drug through Period 1 (14 days). On Day 15, subjects were immediately crossed over to the alternate formulation for Period 2 (Day 15 to 28), without washout, and then down-titrated off study drug. Standard PK assessments were evaluated for all studies including area under the plasma concentration time curve (AUC), maximum plasma concentration ( $C_{max}$ ), minimum plasma concentration ( $C_{min}$ ), time to maximal concentration ( $T_{max}$ ) and terminal half-life ( $t_{1/2}$ ). Key USL255 PK parameters were considered proportional to dose using a power model approach, or equivalent to TPM IR if the 90% confidence interval (CI) for the ratio of dose-normalized geometric least-squares mean (GLSM) values were between 0.8 and 1.25. Deviation from linearity was tested using the type I F test. Fluctuation index (FI) was calculated using the equation  $FI = (C_{max} - C_{min}) / C_{avg}$ . Additionally, one-way ANOVA analyses evaluated  $C_{min}$  and  $C_{max}$  differences between USL255 and TPM IR at SS.

**Results:** USL255 provided linear and dose proportional extent of exposure from 25 to 400 mg. Maximum plasma concentration neared dose proportionality from 100 to 400 mg, and comparison of dose-normalized  $C_{max}$  values (400 versus 200 mg; 200 versus 100 mg)

demonstrated that C<sub>max</sub> changed proportionally with double-dose increases. Total TPM exposure was similar between USL255 and TPM IR after single-dose administration as the GLSM ratio of USL255/TPM IR AUC<sub>0-inf</sub> was 0.91 (90% CI, 0.87-0.95); however, the GLSM ratio of USL255/TPM IR for C<sub>max</sub> was 0.70 (90% CI, 0.65-0.74), indicating a lower C<sub>max</sub> for USL255 than TPM IR. While the presence of food had no significant effect on USL255 bioavailability, indicated by the complete containment of the 90% CIs for the AUC and C<sub>max</sub> GLSM ratios (USL255<sub>fed</sub>/USL255<sub>fasted</sub>), a high-fat meal significantly (P<.05) slowed absorption of USL255 by ~4hr, which is consistent with the PK profile of TPM IR. At SS, USL255 met the FDA definition of equivalence to TPM IR for both C<sub>max</sub> (0.93 [90% CI, 0.90-0.97]) and C<sub>min</sub> (1.06 [90% CI, 1.03-1.09]). Subsequent one-way analyses demonstrated that USL255 had significantly lower C<sub>max</sub> (P<.001) and significantly higher C<sub>min</sub> concentrations (P<.001) resulting in a reduced FI and an improved PK profile as compared with TPM IR. Further, switching formulations did not affect the maintenance of SS TPM plasma concentrations as there were no significant differences between USL255 and TPM IR in the Day 15 (switch)/Day 14 (SS) GLSM ratios for AUC, C<sub>min</sub>, and C<sub>max</sub>.

**Conclusion:** USL has developed a once daily TPM ER formulation (USL255) which provides equivalent TPM exposure, reduced plasma concentration fluctuations, and dose proportionality from 25 to 400 mg.

**Category:** Pharmacokinetics

**Title:** Evaluation of transdermal absorption of ketoprofen in a rabbit model

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**Purpose:** Ketoprofen, R,S- 2-(3-Benzoylphenyl) proprionic acid is a traditional nonsteroidal anti-inflammatory drug (NSAID) commonly administered orally as an anti-inflammatory agent, analgesic, and anti-pyretic. It exerts its action by inhibiting the COX-1 and COX-2 enzymes which mediate the formation of prostaglandin precursors and thus control pain, inflammation, and fever in the body. As an oral preparation, absorption of ketoprofen is almost complete, making this type of therapy very effective. A known adverse effect of this administration route, however, is gastrointestinal irritation and ulceration due to the local effects of prostaglandin synthesis suppression in the gastric mucosa as the drug undergoes absorption. Also, a number of patients are not good candidates for oral therapy due to age, disease state, or other factors. A potential drug delivery system that would overcome these problems is a topical preparation such as a gel. Based on the physiochemical and pharmacokinetic properties of this NSAID, transdermal absorption of ketoprofen is possible. The primary purpose of this study is to assess the extent to which this drug can be absorbed transdermally from a gel preparation and to analyze whether therapeutic drug levels can be achieved to provide systemic anti-inflammatory, analgesic, and anti-pyretic effects. The secondary purpose is to evaluate the rabbit as a useful animal model to test differences in formulation on the amount of drug absorbed from the site of administration.

**Methods:** Ketoprofen and all other materials needed to compound the gel formulations were purchased from Sigma-Aldrich. Lipoderm base was purchased from the Professional Compounding Centers of America (PCCA). Ammonium sulfate was obtained from Acros Organics. HPLC grade acetonitrile was purchased from Spectrum. Xylenes and HPLC grade methanol were procured from Fisher Scientific. Four New Zealand white rabbits approximately 1.5 kg each were obtained from Charles River. The Waters HPLC system included the 717 plus autosampler, a 600 solvent delivery pump, the 486 Tunable Absorbance detector, and a Supelco 18-LC analytical column. The chromatographic separation was performed through injection of 20  $\mu$ L samples at room temperature (22 degrees C) and detected at 265 nm. The mobile phase consisted of 59 percent methanol, 26 percent acetonitrile, and 15 percent water. The mobile phase was delivered at a rate of 1.2 mL/min and time between injections was 10 minutes. Solutions of 0.5  $\mu$ g/ $\mu$ L, 5  $\mu$ g/ $\mu$ L, 10  $\mu$ g/ $\mu$ L, 100  $\mu$ g/ $\mu$ L and 1 mg/ $\mu$ L ketoprofen in acetonitrile were prepared and

used to construct a standard curve. Ketoprofen was formulated into two commonly used transdermal preparations. The first was Pluronic-Lecithin-Organogel (PLO). PLO was made by first preparing the organic and aqueous phases. The organic phase was made by combining 100 g lecithin soya granular, 660 g sorbic acid NF, and 100 g of isopropyl palmitate. The aqueous phase, a pluronic 127 NF 20 percent solution, was prepared by combining 20 g pluronic 127 NF, 300 mg potassium sulfate, and a sufficient quantity distilled water to yield 100 mL of solution. To compound the 1 percent ketoprofen PLO gel, 30 mg of ketoprofen was dissolved in 0.6 mL of the organic lecithin solution and a sufficient quantity of aqueous pluronic 127 solution was added to give a total of 2.4 mL homogenous gel. The second gel was compounded using Lipoderm as a base. Ketoprofen (30 mg) was dissolved in 2 drops propylene glycol and mixed well with a sufficient quantity of Lipoderm base to produce 30 mL gel. The Institutional Animal Care and Use Committee (IACUC) approved the study protocol. The four rabbits were housed in a normal 12 hour light/dark environment with water freely available and were fed 150 g of standard rabbit chow daily along with grass. To carry out this study, a given animal was restrained in a rabbit stock and the inside of one ear was dosed with 0.2 mL of 1 percent ketoprofen gel (1 mg/kg). Blood was collected in heparinized tubes from the marginal ear veins of the opposite ear at time intervals of 0, 0.5, 1, 1.5, and 2 hours. The plasma was separated via centrifugation at 2000 g for 2 minutes and stored at 5 degrees C for further analysis. The extraction procedure utilized a sample of 100  $\mu$ L of plasma to which 400  $\mu$ L acetonitrile was added. This was vortex mixed for 2 minutes and centrifuged at 21000 g for 5 minutes. The clear supernatant was utilized for HPLC analysis. After establishing a steady baseline, the standard and plasma samples were injected and the resulting chromatogram recorded. Linear regression of the standard curve data was calculated by plotting the peak area against the drug concentration in micrograms per millimeter.

**Results:** A standard curve of ketoprofen gave linear results with a correlation coefficient of 0.999 and a retention time of 5 minutes. Unfortunately, an endogenous substance in the rabbit plasma confounded results as both ketoprofen and this substance showed baseline separation at the same retention time, 5 minutes. Peak areas at 5 minutes of plasma samples taken from the rabbits prior to dosing (blanks) were subtracted from peak areas of plasma drawn following the administration of ketoprofen gel. The peaks of the plasma drawn following dosing were not significantly higher than the baseline values for the blank rabbit plasma at the retention time for ketoprofen. The Lipoderm gel showed slightly higher peaks in comparison to the PLO gel formulation.

**Conclusion:** The observation that the peaks of the plasma samples taken after the application of ketoprofen were not significantly higher than those of the blank baseline indicates that significant systemic absorption of ketoprofen from a transdermal gel preparation could not be detected. This finding suggests that the efficacy and therapeutic value of commercially available topical ketoprofen and other NSAID preparations is not equivalent to that of an oral dosage system. The results of this study also bring into question the usefulness of a rabbit model to test potential transdermal absorption in vivo due to significant metabolic and physiological differences from a human model. Future studies should first develop a better assay method that avoids the interfering peak in the plasma and examine a series of dose levels using the Lipoderm base.

**3-195**

**Category:** Pharmacokinetics

**Title:** Development and Implementation of a Phenytoin Training Manual for Pharmacists at UAB Hospital

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**Purpose:** The purpose of this project is to assess UAB Hospital pharmacists knowledge of phenytoin pharmacokinetics/pharmacodynamics and develop a standardized training manual for pharmacists in order to improve pharmacists knowledge related to phenytoin management among inpatients at UAB Hospital.

**Methods:** Eligible participants are all pharmacists employed at UAB Hospital. A team of pharmacists developed a training manual utilizing available literature and resources on phenytoin pharmacotherapy as well as clinical experience. Pharmacists will complete a twenty-five question multiple-choice pre-training manual survey on the information in the manual via the Pharmacy department intranet. After the exam, the training material will be posted for the pharmacists to review. The original survey will be re-administered two weeks after the material is posted to evaluate the effectiveness of the training manual and pharmacists knowledge of phenytoin.

**Results:** A total of 41 pharmacists participated in the pre-survey and a total of 28 pharmacists participated in the post-survey. Twenty-eight of the pharmacists who completed both the pre- and post- training manual survey were then reviewed for analysis. Average survey scores ranged on the pre-training manual survey of 56% (ranging from 20 to 76%). Pharmacists with greater than 2 years of experience scored on average 30% lower than those with greater than 10 years of experience, while those with added qualifications of either residency training or BCPS scored 5% worse on average prior to reviewing the training manual. After review of the training manual, average survey scores increased in all of the categories analyzed. Overall average scores increased by 22% from 56% pre-training manual survey to 78% post-training manual survey. In addition, the total number of passing scores defined as 70% or greater increased from 14% to 83% of respondents. Those with less than 2 years of experience had the greatest increase in average scores from 25% to 79%.

**Conclusion:** A phenytoin training manual improved pharmacists knowledge related to phenytoin pharmacokinetic and pharmacodynamic properties as indicated in the overall improved average scores when compared to scores prior to reviewing the training manual.

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**Category:** Pharmacokinetics

**Title:** Impact of concomitant magnesium oxide administration on oral bioavailability of gabapentin in cancer patients with neuropathic pain

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**Purpose:** Cancer patients receiving gabapentin for neuropathic pain are often administered magnesium oxide (MgO) at the same time to treat opioid-induced constipation in Japan. However, the pharmacokinetic interaction between gabapentin and MgO has not been fully evaluated in clinical settings. The aim of this study was to evaluate the influence of concomitant MgO on oral bioavailability (BA) of gabapentin in cancer patients with neuropathic pain.

**Methods:** Ten cancer neuropathic pain patients receiving gabapentin and MgO at Hamamatsu University Hospital were enrolled in this study. The gabapentin BA was obtained by dividing its amount in 24-hour urine by the daily dose. In addition, 13 healthy subjects were enrolled in pharmacokinetic study. In the study, gabapentin (200 mg) was orally administered alone, with 1 g MgO, or with 20 mg omeprazole to healthy adult subjects. The difference in the gabapentin BA between those treatments was analyzed to clarify the interaction mechanism.

**Results:** The gabapentin BA in cancer patients with neuropathic pain were lower than that of gabapentin alone treatment in healthy subjects. The gabapentin BA in the MgO treatment was significantly lower compared to the alone and omeprazole treatments, respectively. There was no significant difference in the gabapentin BA between the alone and omeprazole treatments. The C<sub>max</sub> and AUC of MgO treatment were significantly lower than that of the alone and omeprazole treatment, respectively. In contrast, no significant differences were observed in the C<sub>max</sub> and AUC of gabapentin between the alone and omeprazole treatments.

**Conclusion:** Concomitant MgO decreased the intestinal absorption of gabapentin in cancer patients with neuropathic pain. This reduction caused by concomitant MgO was not associated with the suppression of gastrointestinal acidification caused by antacids. Concomitant MgO administration may reduce the gabapentin exposure through a reduction of its intestinal absorption in cancer patients with neuropathic pain.

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**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Development and validation of a survey to assess patient knowledge about medications and confidence in their use

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**Purpose:** The purpose of this research was to develop a simple and content-valid survey that could be used to assess patient medication knowledge and confidence in medication-taking across a variety of health care settings.

**Methods:** A prospective, observational study was conducted in a 380 bed community hospital, which has a level II trauma center. Convenience samples of cognitively aware patients who were able to provide adequate information were selected. Study investigators were not involved in patient selection, interviewing or collection of surveys. Using a 5-point Likert scale, 10 survey questions to assess patient's level of confidence and knowledge of their medication use were developed and evaluated by 4 expert jurors. Content was then revised based on the experts recommendation to include an item querying the number of medications the patient was currently taking. The revised survey was reviewed by the experts and subsequently approved by the institution's Scientific Review Board and Institution Review Board (IRB). Psychometric analysis was conducted in two stages to validate the reliability of the survey (Okere-Renier survey). Cronbach's alpha was used in testing the reliability and validity of the instrument. Cluster analysis of squared Euclidean distance of the between group linkages for mean knowledge response (5-Item), mean confidence response (adjusted), and satisfaction, was used to distinctively group patients into either good knowledge/confidence/satisfaction or poor knowledge/confidence/satisfaction. This was essential for producing a set of discrete, possibly symmetrically spaced, clusters that best summarize the data as defined by the investigators.

**Results:** 10 original questions assessing patient knowledge, confidence and satisfaction, were determined appropriate by the expert content jurors. Cronbach's alpha  $> 0.7$  was used to validate the reliability of the survey. Stage 1 (n= 49) and Stage 2 (n=469) of the psychometric analysis showed that the final question knowledge scale to be a Cronbach's alpha of 0.833 and 0.743 respectively. Furthermore, using the cluster analysis model, patients were categorized to two groups; good or poor knowledge/confidence/satisfaction with medication use ( $P < 0.05$ )

**Conclusion:** The Okere-Renier survey appears to be a simple, valid and reliable instrument for assessing patient medication knowledge and medication-taking confidence. The Okere-Renier survey can be used as a baseline screening tool to help individualize patient education, target

deficiencies in knowledge and to help improve confidence in medication-taking, ultimately enhancing adherence.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** The Impact of pharmacist-led medication reconciliation service (MRS) in the reduction of emergency room (ER) readmissions.

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**Purpose:** The primary aim of this study is to demonstrate that a pharmacist-led provision of medication reconciliation in collaboration with a physician, during medication optimization prior to discharge, will sustain reduction in emergency room readmission rates. Furthermore, it will increase patient satisfaction, knowledge and confidence in medication use.

**Methods:** Setting: This MRS Study was a three month prospective, observational cohort study, conducted in a 380-bed Trauma II community hospital. The study was approved by the institution's Scientific Review Board (SRB) and Institutional Review Board (IRB). Instrument development: A five-point Likert scale survey was designed to obtain information regarding patients' confidence and knowledge of medication use. To validate the survey tool, a psychometric analysis was conducted. Cronbach's alpha and cluster analysis were used in testing the reliability and validity of the survey. Patient selection: Eligible patients were identified through the emergency room (ER) by a clinical research assistant and were randomly assigned to either the intervention group (MRS), or the non-intervention group (non-MRS). Medication record numbers of enrolled patients were documented to prevent crossovers from one study group to the other and to prevent multiple surveying of the same patient if multiple visits occurred during the study period. Study investigators were not involved in patient selection, interviewing or collection of surveys. Data Collection: To evaluate the impact of MRS on patients subsequent inpatient hospitalizations and ER visits, health system databases were queried. A 90-day follow-up survey was conducted by a research assistant to determine if patients used any ER or hospitals outside of the primary hospital within 30 days, 60 days and 90 days post-index ER visit. Also, data pertaining to patients' compliance to medication and long-term patients' confidence in their medication use, and knowledge about their medications were collected. The survey process included an initial questionnaire mailing, a follow-up questionnaire mailing two weeks later to non-respondents, and a follow-up telephone call to conduct a CATI two weeks after the follow-up questionnaire mailing (for those who have not returned their completed questionnaire).

**Results:** Based on our study, the number of any ER visits among non-MRS group (n=152) were 1.3 times more than the MRS group (n= 265). This study reveals the potential role of pharmacist-led medication reconciliation in the reduction of ER visit or inappropriate use of ER.

Furthermore, patients who received MRS indicated improved confidence in their medication use over the follow-up period compared with the non-MRS group ( $P < 0.05$ ). However, no significant differences were observed between groups regarding changes in knowledge about medication use and satisfaction with explanation given about their medications. Changes in number of medications taken post-index ER visit may have contributed to the differences in patients confidence in medication use and/or the lack of differences observed in knowledge and satisfaction.

**Conclusion:** Based on our study, implementation of a pharmacist-led medication reconciliation service resulted to reduced ER visits or inappropriate use of ER.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Physical and chemical stability of injectable acetaminophen

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**Purpose:** Acetaminophen is commonly administered to patients who are febrile or in mild to moderate pain. An intravenous formulation of acetaminophen was approved for use by the Food and Drug Administration in 2010. The purpose of this study was to determine the physical and chemical stability of injectable (IV) acetaminophen with acyclovir, cefoxitin, ceftriaxone, piperacillin/tazobactam, vancomycin, granisetron, ondansetron, diphenhydramine, ketorolac, diazepam, lorazepam, and nalbuphine during simulated y-site administration. The stability of IV acetaminophen 10 mg/mL stored in polypropylene syringes at room temperature was also assessed.

**Methods:** Simulated y-site administration was performed by combining 2 mL of IV acetaminophen with 2 mL of the secondary drug solution in a 10 mL polypropylene syringe. Physical stability was determined in triplicate by visually inspecting each syringe, initially and at 4 hours, for particulate matter. Each 4 mL aliquot was filtered through a 0.45-micron nitrocellulose filter and analyzed quantitatively for crystal precipitates under 100x magnification. Compatibility was determined by USP limits of less than 12 particles/mL measuring d10 m and less than 2 particles/mL measuring d 25 m in diameter. Chemical stability was determined in triplicate using high-performance liquid chromatography with diode-array detection initially and at hours 1 and 4. Agents were defined as being chemically stable if greater than 90% of the original drug concentration remained. To assess the stability of IV acetaminophen as a single agent, four polypropylene syringes containing acetaminophen 10mg/mL were prepared from commercially available product. Each syringe was subjected to room temperature storage 20-25oC. The percent of the initial concentration remaining was assessed in triplicate on days 1, 2, 14, 21, and 28 for all syringes. Chemical stability was defined as previously described.

**Results:** Visual clarity was maintained in all aliquots at 0 and 4 hours, except for diazepam and lorazepam. USP standards, for particulate matter, were met with all medications except for acyclovir, diazepam, and lorazepam exceeding the number of crystals allowed. Cefoxitin, ceftriaxone, piperacillin/tazobactam, vancomycin, ondansetron, granisetron, diphenhydramine, ketorolac, and nalbuphine were found to be y-site compatible with acetaminophen at room temperature. At 20-25oC IV acetaminophen stored in polypropylene syringes exhibited less than

10% loss over the duration of the study. The single agent acetaminophen samples showed no visible signs of precipitation.

**Conclusion:** Injectable acetaminophen is incompatible with acyclovir, diazepam and lorazepam and therefore should not be administered concomitantly with any of these products. All other medications studied exhibited y-site compatibility with acetaminophen. Acetaminophen (10 mg/mL) for injection stored in polypropylene syringes is chemically stable for 28 days at 20-25oC.

### 3-200

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Does early antibiotic administration decrease the overall length of stay in acute exacerbation of chronic obstructive pulmonary disease?

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**Purpose:** Guidelines recommend antibiotic use in Acute Exacerbation of Chronic Obstructive Pulmonary Disease (AECOPD) based on the Anthonisen Criteria. Additionally in Community Acquired Pneumonia (CAP), antibiotics have been shown to decrease the overall length of stay (LOS) when administered within four hours of admission. Due to disease state similarities between COPD and CAP we hypothesize that early antibiotic administration will result in a decreased length of inpatient stay in AECOPD.

**Methods:** Study Approval was granted through the Institutional Review Committee. A retrospective review of the Electronic Medical Record for patients admitted through the Emergency Department with an AECOPD over a 24 month period was conducted for all patients with ICD-9 code 491.21 (AECOPD) as the primary discharge diagnosis. Patient population variables were compared via Chi Square analysis to evaluate baseline characteristics. The primary endpoint evaluated LOS for early (within four hours) versus late (after four hours) antibiotic administration with calculation of an odds ratio (OR) with 95% confidence interval (CI.) Secondary endpoints, also with OR (95% CI), were evaluated where two hours replaced four hours as the cutoff for early versus late administration and again at four hours with only patients who had no record of antibiotics prior to admission.

**Results:** The primary endpoint evaluating LOS for early antibiotic administration at four hours resulted in OR 1.0 (0.637-1.57.) The secondary endpoints yield OR 1.0 (0.61-1.639) for antibiotic administration at two hours and OR 1.14 (0.671-1.849) for antibiotic administration at four hours in antibiotic nave patients

**Conclusion:** No significant result with early antibiotic administration regardless of previous antibiotic exposure was found. While CAP is known to be bacterial in nature, AECOPD has multiple potential causes (bacterial, viral, environmental, etc.) which antibiotics would not impact against regardless of time to administration. It is likely that exacerbation cause contributes highly to the lack of an effect in these results.

**3-201**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Impact on outcomes with inpatient pharmacy practice model change

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**Purpose:** The objective of the study is to compare 30 day readmission rates and patient satisfaction scores before and after implementation of a patient centered practice model.

**Methods:** The study was conducted using a longitudinal pre-post intervention study design. The patient centered practice model was initiated on August 2011. All patients admitted with CHF as a primary or secondary diagnosis receive inpatient pharmacist discharge counseling which includes a review of disease-specific patient education material. Weekly follow-up phone calls were conducted by pharmacists to assess medication adherence and monitor for signs and symptoms of decompensation. Patients who were experiencing signs and symptoms identified as urgent requiring intervention were referred to their cardiologist for an outpatient clinic visit. The study tracked CHF 30-day readmission rates and HCAHPS patient satisfaction scores with a focus on the Communication of Medication domain from September 2011 through December 2012. Historical performance of these outcome measures from September 2010 through December 2010 were used as the comparator group.

**Results:** The mean all-cause readmission rates were similar before and after new practice model implementation (11.65 and 12.13, respectively). The mean CHF readmission rate improved by 15.6% ( $p=0.04$ ). Between October 1st 2011 and January 30th 2012, 194 patients were called for assessment and follow up CHF education. Of these, pharmacists were able to reach 106 patients via phone; 20.6% of patients reached needed additional intervention beyond reinforcement of education. The HCAHPS Medication specific domain score improved 5 out of 6 months achieving a higher score post patient centered practice model implementation.

**Conclusion:** Since the initiation of the patient centered pharmacy practice model, a significant reduction in CHF 30 day readmissions was seen. Pharmacist education and follow up phone calls appear to have played a role in the prevention of CHF readmissions by facilitating transitions of care and improving medication adherence.

**3-202**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Simulating Framingham Risk reductions to assess applicability as a global study endpoint: Report from the P.A.T.H. Steering Committee

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**Purpose:** Multimodal intervention studies require a comprehensive outcome to fully assess impact. For lifestyle interventions in metabolic syndrome (MetS) patients, the most appropriate study endpoint for efficacy outcomes is unknown. Framingham 10-year risk % (FR) may be a reasonable endpoint for these studies; however, the sensitivity of this measure to relatively small changes in the components used to calculate it is not well studied. We aimed to simulate FR changes to determine its applicability as a global endpoint for future studies in a MetS population.

**Methods:** A random sample of 110 family medicine patients was identified using ICD-9 diagnosis codes. For each patient, data were collected for gender, age, systolic blood pressure (SBP), presence/absence of antihypertensive therapy, total cholesterol (TC), high-density lipoprotein (HDL), and smoking status and a baseline FR was calculated. A hypothetical post-intervention FR for each patient was calculated by applying the mean change in each modifiable component variable as reported in a recent lifestyle intervention study.

**Results:** Fifty-nine subjects were male and 26 were smokers. At baseline, subjects had a meanSD age of 62.412.2 years, SBP of 14015 mmHg, TC of 178.742.9 mg/dL, HDL of 39.610.9 mg/dL, and FR of 13.4% (median=11.6%). Using a mean change in SBP of -6.5 mmHg, TC of -21.3 mg/dL, HDL of +4.7 mg/dL and maintenance of smoking status, we calculated a mean hypothetical post-intervention FR of 10.1% (median=8.3%) for a mean absolute FR reduction of 3.3% ( $p < 0.0001$ ). Twenty-seven subjects switched to a lower-risk category.

**Conclusion:** In this simulation study, FR was sensitive to relatively small changes in FR component variables. Consequently, interventions that demonstrate small but significant improvements in modifiable FR components (e.g. BP, cholesterol parameters) can significantly impact FR. Change in FR may be applicable as a global efficacy endpoint in multicomponent intervention studies in MetS patients.

**3-203**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Evaluating the impact of a pay-for-outcomes program rewarding primary care physicians for optimal LDL-C management

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**Purpose:** Within the Humana Medicare member population, a pay-for-outcomes (P4O) program was implemented 1/1/2010 through 12/31/2010, rewarding primary care physicians (PCPs) whose patients achieved or maintained low-density lipoprotein cholesterol (LDL-C) levels at or below 100 mg/dL. This study evaluated the impact of the P4O program for participants relative to a matched comparison cohort.

**Methods:** The retrospective cohort study utilized member enrollment, medical, pharmacy, and laboratory claims data from Humana. The intervention cohort comprised Medicare Advantage HMO members whose designated PCPs were participating in the P4O program. A comparison cohort was identified from Medicare Advantage HMO members in the same or nearby regions whose PCPs were not participating in the P4O program. P4O cases were matched to controls in a 1:3 ratio based on propensity score matching. To assure that the two groups were similar in terms of baseline patient characteristics, we matched on the following baseline variables: cardiovascular (CV) risk (adaptation of Bullano, *Pharmacotherapy* 2006), age, gender, ethnicity, RxRisk comorbidity score, utilization of LDL-C screening, availability of LDL-C values from laboratory claims, CV-related hospital stay and ER visit, and healthcare spending. Descriptive results were evaluated to determine how well the two groups were matched in terms of patient and physician characteristics. The impact of the P4O program was assessed by two outcomes: achieving or maintaining LDL-C goal and total healthcare costs. Logistic regression was conducted to estimate the odds ratio of achieving or maintaining LDL-C goal for the P4O participants relative to the non-P4O cohort. Similarly, total healthcare costs were compared between groups and assessed through a difference-in-difference (DID) generalized linear model with a log link and gamma distribution (generalized estimation equation method accounted for repeated measures).

**Results:** A total of 3,280 P4O program participants were identified in the Humana member administrative claims data, of whom 1,565 were new to Humana in 2010 and 1,715 were continuously enrolled in 2009 and 2010. For each of the continuously enrolled participants there were 3 matched controls, or 5,145 non-P4O participants. Overall, the baseline characteristics of

the P4O participants and non-P4O cohort were well-matched. Descriptive statistics showed that for the P4O participant cohort, the mean age was 71.2 years, 57.0 percent were women, and 47.4 percent were at high CV risk. For the non-P4O cohort, mean age was 71.5 years, 56.1 percent were women, and 47.4 percent were at high CV risk. Within both groups, the mean LDL-C value decreased from 2009 to 2010. A higher percentage of the P4O cases achieved or maintained goal in 2010 compared with their matched controls (71.5 percent vs. 63.5 percent,  $p$  equals 0.047). The difference between the two groups was driven primarily by members with LDL-C who were less than 100 mg/dL in 2009 and who maintained goal in 2010 ( $p$  equals 0.043). P4O participants had higher odds of achieving or maintaining LDL-C goal if they were high CV-risk patients (odds ratio [OR]: 1.572, 95 percent confidence interval [CI]: 1.086 {2.277}). No difference was observed in achieving or maintaining LDL-C goal among the low or moderate CV-risk patients (OR: 0.725, 95 percent CI equals 0.385 {1.364 for low CV-risk patients; OR: 1.014, 95 percent CI equals 0.622 {1.645 for moderate CV-risk patients}). In the DID total healthcare cost model, the P4O program was associated with a reduced increase in total costs relative to 2009, in comparison to non-participation (increase of \$430 for P4O versus \$1,770 for non-P4O,  $p$  equals 0.01).

**Conclusion:** Overall, this P4O program was effective in maintaining or achieving LDL-C goal, with the largest impact being driven by members maintaining their goal and those who were at high CV risk. Additionally, total healthcare costs rose less in the P4O participant group than in the non-P4O cohort. Although these results suggest that a P4O initiative may have had an impact on Medicare patients, further research is needed over a longer period of time, with a larger sample size, and in other populations to determine the applicability of these results.

**3-204**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Economic evaluation of fingolimod with budget implications for MassHealth

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**Purpose:** Recombinant interferons and glatiramer acetate, the mainstay of current multiple sclerosis (MS) therapy, are only available in injectable formulations. In 2010, fingolimod was introduced to the market as the first oral therapy for decreasing the progression of MS. The cost of this new drug is higher than that of traditional MS agents, although differences in the overall costs associated with treatment may make it a viable option for use. A recent economic evaluation has identified that some more expensive therapies may be cost effective based on their ability to reduce the likelihood of relapses in patients with relapsing-remitting MS (RRMS). In May 2012, the FDA announced new warnings for fingolimod following the death of a patient after receiving one dose of the drug. Fingolimod is now contraindicated in certain patients with cardiac abnormalities, those who have had cardiac events within 6 months of therapy initiation, and in those taking certain anti-arrhythmic medications. The purpose of this evaluation was to examine the budget implications associated with adopting fingolimod into the standard treatment of MS from the perspective of MassHealth, a Massachusetts Medicaid and CHIP combined insurance program.

**Methods:** A systematic literature review was performed on both clinical and economic evidence related to fingolimod. Seventy-two studies were identified as clinical evidence from a PubMed search that included randomized controlled trials in English that pertained to drug efficacy, disability, or progression of disease. The budget impact analysis was performed from a government payers perspective over a time horizon of one year, with the intention of evaluating the use of fingolimod in scenarios as both first and second line treatments of RRMS. Two base cases were conducted, the first analyzing fingolimod as a first line therapy option for newly diagnosed patients and the second with fingolimod as a second line therapy option following failure of another therapy. The distribution of each current therapy among the patients in our model was determined from a retrospective cohort study of a US administrative health claims database of commercially insured patients with MS.

**Results:** Studies that compared fingolimod to beta-interferon therapies or placebo found either equal or greater efficacy with fingolimod. These studies also identified several safety concerns regarding fingolimod, which include bradycardia and atrioventricular blocks, infections, macular

edema, respiratory effects, and hepatic effects. Twenty-eight economic studies detailing costs of drug treatment in relapsing-remitting MS (RRMS) were identified. None of these studies specifically addressed fingolimod due to its recent introduction to the market. Economic evidence of current injectable treatments supports that newer, more expensive medications may prove to be cost effective by further reducing relapse rates and slowing disease progression. The population was estimated using the number of patients with MS in Massachusetts, the prevalence of RRMS among all patients with MS, and the enrollment rate of MassHealth to calculate an estimated 2,040 patients with RRMS covered by MassHealth in 2010. The costs associated with each treatment were found on the MassHealth online claims database as cost per claim. In the first line therapy scenario, we modeled oral versus injectable therapy based on an estimation that 17% of patients may miss an injection due to anxiety or dislike of needles, based off a study comparing daily oral therapy and monthly injectable treatments in chemotherapy. This change in patients resulted in a \$2.3 million increase per year, reflecting a 2.94% increase in MassHealth's budget for MS treatment. Sensitivity analyses showed the estimate was sensitive to the cost of the medication, with a 15% decrease in medication cost resulting in a breakeven point with the current budget cost. In the second line therapy scenario, we took into account patient preference for oral versus injectable treatments. Based on a previous study of interferon and glatiramer acetate, an estimated 28% of patients would fail first line therapy. Of these patients, we estimated 63% would choose oral over injectable therapy when presented with a choice of formulation, based on the same study utilized in the first scenario. This second line therapy scenario resulted in a \$2.5 million increase per year, an 11.2% increase over current therapy costs for second line treatment. Analysis showed the second model likewise sensitive to the medication cost with a 15% decrease in cost resulting in a breakeven with the current budget costs for second line treatment. Additionally, the number of patients failing first line therapy also significantly affected the scenario. The analysis did not take into account reduction in relapse rates, safety profiles, or that the study the model was based on monthly injections and not the more frequent administration of treatment seen in MS treatment.

**Conclusion:** Our economic evaluation shows that adopting fingolimod as a first line therapy could be budget neutral with a 15% decrease in price, given equivalent efficacy. The current medication cost and concerns about adverse events are limiting factors in its use as first line and second line therapy. There are complex clinical tradeoffs of oral versus injection formulations of which the implications have yet to be evaluated. Subsequent studies should focus on long term risks and benefits of fingolimod, comparing adherence between oral and injection therapies, and reduction of relapse rates and disease progression.

**3-205**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Clinical and economic evaluation of bortezomib for salvage therapy in relapsed or refractory multiple myeloma patients with implications for the Medicare budget

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**Purpose:** Bortezomib (BTZ), an antineoplastic agent, is regarded as one of the most recommended therapy options in the treatment of all stages of multiple myeloma (MM). Although the most common route of administration for BTZ has been via intravenous (IV) bolus, the newly-approved subcutaneous (SC) route is shown to be as efficacious, in addition to decreasing the incidence of bortezomib-induced peripheral neuropathy (BIPN). The purpose of this study was to conduct a clinical and economic evaluation of SC administration of BTZ for decision-makers and to estimate the budget impact of SC compared to IV bolus administration of BTZ from the Medicare payer perspective.

**Methods:** A systematic literature review of clinical efficacy and economic implications of BTZ use in treatment of relapsed or refractory MM was conducted. A budget impact analysis regarding the use of BTZ administered via SC route was conducted from the perspective of Medicare part B and part D.

**Results:** Efficacy of BTZ use in patients with relapsed or refractory MM is strongly supported by well-conducted clinical trials. The use of BTZ alone or in combination with lenalidomide (LEN) and dexamethasone (DEX) in relapsed or refractory MM resulted in prolonged time to disease progression and increased rate of overall survival, as shown by APEX and MM-009/010 trials. The efficacy of the combination of all three of these agents, also known as the RVD regimen, has been demonstrated by a 100% overall response rate in newly-diagnosed patients with MM. The existing economic analyses show conflicting results on cost-effectiveness of BTZ administered via IV route when used as a salvage therapy option for refractory or relapsed MM. The budget impact on Medicare between the two routes was estimated to be \$1.39 billion based on the fact that 33,777 Medicare beneficiaries with relapsed or refractory MM would receive BTZ treatment as salvage therapy. The factors that resulted in the savings favoring the SC route of administration included the cost differences in hospital reimbursement (\$128.44 for IV bolus vs \$36.88 for SC) and treatment of BIPN with pregabalin (Lyrica) annually (\$782,889 for IV bolus vs \$28,996 for SC). The results continued to be robust even after the assumptions made for the base-case scenario were challenged through sensitivity analyses. Altering the proportion of

patients receiving BTZ via either route (0.1 to 1) or the number of patients who relapse or become refractory did not change the direction of the results (\$98 million to \$1.6 billion).

**Conclusion:** Although the administration of BTZ via IV bolus injection is currently more common in practice, adoption of SC injection as the standard route of BTZ administration could produce savings for Medicare part B and D of \$1.39 billion. As evidenced by the results of the clinical and economic analyses, SC route of administration for BTZ may be considered as a safer alternative to IV bolus route with fewer burdens on the Medicare budget.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Clinical and economic evaluation of ivacaftor for treatment of cystic fibrosis patients with implications for the MassHealth budget

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**Purpose:** To determine the clinical and economic evaluation of ivacaftor for treatment of cystic fibrosis in patients with G551D mutation who are on MassHealth insurance, a program for low to medium-income residents of Massachusetts. Medicaid and Childrens Health Insurance Program (CHIP) are also a part of this program.

**Methods:** A systematic literature review of ivacaftor was conducted in PubMed, the Cochrane Library, and ClinicalTrials.gov. To evaluate the economic impact of treating exacerbations the following search terms were searched in PubMed: cystic fibrosis AND pharmacoeconomics, J Med Econ[jour] AND cystic AND fibrosis, Pharmacoeconomics[jour] AND cystic AND fibrosis, cystic AND fibrosis AND VX-770. Of the 46 articles identified, only three met the inclusion criteria of costs associated with acute exacerbations of cystic fibrosis. A budget impact analyses was conducted in the perspective of MassHealth in which ivacaftor would be approved for addition to current maintenance therapy for the year 2010. Scenarios compared are the addition of ivacaftor to maintenance therapy and do nothing which entails use of only currently approved maintenance therapy of cystic fibrosis. Wholesale acquisition cost, co-payments, and discounts were used to estimate total drug cost to MassHealth. Sensitivity analyses were performed for the number of patients eligible, forced expiratory volume in one second (FEV1), pulmonary exacerbations, and cost of drug. The population was limited to patients eligible for both treatment with ivacaftor and support through MassHealth, using data from the Cystic Fibrosis Registry.

**Results:** Of the 21 unique articles identified, only two were randomized controlled trials. They demonstrated that ivacaftor has a benefit in improving cystic fibrosis transmembrane conductance regulator (CFTR) ion-channel and lung function, as measured by surrogate endpoints of sweat chloride and FEV1. Published economic studies showed that ivacaftor will add to the cost of treating these already expensive patients. However, these studies show that FEV1 is negatively correlated with hospitalization costs. Therefore, patients taking ivacaftor should have a lower incidence of hospitalizations and severity of exacerbations but no such data are available yet. Taking the MassHealth payer perspective and based on data from the 2010 Cystic Fibrosis Registry, estimated hospitalization costs per patient with cystic fibrosis average

about 6,600 United States dollars (USD). The annual cost of ivacaftor through MassHealth is estimated to be about 250,000 USD per individual patient. Based on data from the 2010 Cystic Fibrosis Registry, an estimated sixteen patients would be eligible for ivacaftor under MassHealth coverage. The treatment of eligible patients with ivacaftor would increase MassHealth's total costs by 4 million USD annually, which would have been 0.04 percent of the MassHealth budget in 2010. Through various scenarios, based on predicted improvement of FEV1 with use of ivacaftor, annual hospitalization costs savings were estimated to range from 4,125 to 5,375 USD per patient.

**Conclusion:** Cystic fibrosis carries a high disease burden and ivacaftor is the first drug that targets the G551D mutation. Addition of ivacaftor to formulary would cost MassHealth 4 million USD. If optimal improvements in FEV1 and correlated decreased costs of hospitalization are not achieved through use of ivacaftor, a risk of no cost savings associated with an increase in annual hospitalization costs exists. Cost studies of long-term implications are needed.

3-207

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Estimated Cost Avoidance Associated with a Pharmacist-CDE Led Diabetes Intense Medical Management and Education Clinic

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**Purpose:** The purpose of this analysis was to estimate cost avoidance associated with improved glycemic control for patients with type two diabetes mellitus (T2DM), whose therapy was managed in a day per week pharmacist-led Diabetes Intense Medical Management (DIMM) Clinic, at the Veterans Affairs San Diego Healthcare System (VASDHS).

**Methods:** A published regression model (Gilmer et.al., 2009) was used to estimate total medical costs over a three-year period (including inpatient and outpatient services) for two groups of patients receiving six months of diabetes care: patients referred to the DIMM Clinic (n=58) vs. a randomly selected comparator group of patients being seen by their primary care provider (n=58). Study subjects were greater than 18 years old, diagnosed with T2DM with HbA1c greater than or equal to 8% at initial DIMM Clinic visit (or index visit for comparator group). Data used to populate the regression model were collected via retrospective chart review. Estimated three-year total medical cost was based on age, gender, the existence of specific co-morbidities (hypertension, hyperlipidemia and heart disease), as well as HbA1c. Cost avoidance in each group was defined as the difference between the cost estimated using data from the initial/index visit vs. the cost estimated using data from 6 month visit. Since HbA1c was the primary variable that could change during the six-month study period, the cost avoidance estimates mainly reflect the change in HbA1c.

**Results:** Patient age, gender, and presence of co-morbid hypertension and dyslipidemia were similar between the DIMM Clinic and comparator group subjects. Baseline HbA1c and proportion with heart disease were greater in the DIMM Clinic patients vs. the comparator group [HbA1c 10.4% (SD1.4) vs. 9.7% (SD1.7), p=0.03; heart disease 62% vs. 38%, p=0.04]. Mean change in HbA1c was significantly greater for DIMM patients [-2.6(SD1.9) vs. the comparator group -0.5(SD2.5), p<0 .001]. The estimated mean total medical cost avoidance due to improvement in glycemic control was \$9,063 per patient over three years in the DIMM Clinic group compared to \$1,622 in the primary care provider group. Sensitivity analysis assuming an increase in HbA1c of 1% for each DIMM patient decreased the mean total medical cost avoidance over three years to \$6,455 per patient; still almost four-fold greater than the comparator group. A conservative return on investment was estimated to be \$4.80 per dollar

spent for the DIMM pharmacist, based on \$543,780 estimated cost avoidance over 3 years for a 60 patient cohort (current annual capacity of day per week DIMM Clinic) and \$112,500 pharmacist cost (assuming patients continue to be managed by pharmacist over 3 years).

**Conclusion:** This study demonstrated that a pharmacist-CDE-led DIMM Clinic was associated with a greater total medical cost avoidance compared to similar patients followed by their primary care providers, and a return on investment of \$4.80 per dollar spent. Pharmacists are an under-utilized resource that can assist physicians in the management of patients with chronic disease states such as diabetes. Future prospective larger controlled trials, including collection of costs incurred, should be conducted in this area to confirm these results.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Economic Implications of Liraglutide for a State Health Insurance Program for Low-to-Middle Income Residents

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**Purpose:** Liraglutide is a GLP-1 agonist that is FDA approved for adjunct to diet and exercise to improve glycemic control in adults with type 2 diabetes mellitus (DM). Current American Diabetes Association (ADA) guidelines include the use of liraglutide as add on to 1st line therapy of metformin and lifestyle modifications when adequate glycemic control is not achieved. However, the preferred route of intensification of therapy to achieve glycemic control consists of adding 2nd line oral antidiabetic agents, or a regimen with insulin, rather than the addition of a GLP-1 agonist. The purpose of this study was to determine the cost impact of using liraglutide in comparison to insulin glargine within type 2 DM adults who are low to middle income residents that have state provided insurance as primary insurance coverage.

**Methods:** A systematic review of both clinical and economical evidence in PubMed was conducted. The results of the PubMed search were examined to determine the applicability of the studies as well as the strengths and weaknesses within the studies. A budget impact analysis was performed by comparing the costs with a budget including liraglutide and one without. The MassHealth payer perspective served as a representative population of low to middle income individuals on a state funded insurance program. The type 2 DM adult population was determined based on statistics provided by Massachusetts HEDIS reports. Men and women aged 18 to 65 years old who currently have a diagnosis of type 2 DM were included. Four groups were classified, including patients on metformin only, patients on liraglutide, patients on insulin glargine, and patients on insulin glargine who were previously on liraglutide. In the arms consisting of either liraglutide or insulin glargine, patients were also on the baseline of metformin. The cost impact was set to be examined over a three year period, analyzing the outcome of a yearly MassHealth budget with and without liraglutide. The number of patients within each of the four groups were based on current estimated market share values of each antidiabetic agent, and would increase or decrease based on estimated trends of antidiabetic agent use. Costs were based on the costs associated with medication use, complication costs, glucose testing supplies costs; yearly physician visits were excluded. The cost of medication use was based on the average wholesale acquisition cost of the drug plus the dispensing fee of the medication. Costs were standardized by making the assumption that all patients within each arm were using the same daily dosage of medication and were testing glucose at the same rate. The

total yearly costs were determined based on the combined costs of antidiabetic medication use, complication costs and glucose testing supplies. Sensitivity analyses were conducted by selecting various differences in medication use and complication cost. The variables analyzed included change in medication dosages, increase in medical complications and decrease in medical complications.

**Results:** Main clinical evidence of liraglutide consisted of the six LEAD trials, which compared liraglutide to insulin glargine, exenatide and 2nd line oral antidiabetic agents. It was found that liraglutide had a significant decrease in the HbA1c levels compared to the other agents in each of the six LEAD trials. Economical evidence consisted of the comparison of liraglutide to exenatide as well as to oral antidiabetic agents. Although there is no direct cost effectiveness evidence of liraglutide compared to insulin glargine, there has been studies comparing exenatide to insulin glargine. It was found that liraglutide seems to be more cost effective than exenatide, and that exenatide seems to be more cost effective than insulin glargine. The budget impact analysis showed that the addition of liraglutide to the MassHealth budget would result in an approximate \$3.5 million per year increase per 10,000 patients in the first year. The second year showed an increase in \$3.2 million while the third showed an increase of \$3.1 million. Sensitivity analyses explored the impact of amount of insulin used, daily dose, adverse events, and other inputs. In the scenario that patients were using two boxes of insulin glargine pen rather than one box per month, liraglutide added \$1.5 million in comparison to the \$3 million in the base case. If patients were on the daily dose of 1.2 mg liraglutide rather than 1.8 mg, then liraglutide added \$1.6 million. An increase in 50% of all adverse events of the patients on liraglutide resulted in an additional \$5.4 million, while a 50% decrease in all adverse events of the patients on liraglutide resulted in a cost of \$1.4 million. The addition of liraglutide to the MassHealth budget added \$1.4 to \$5.4 million for the range of inputs explored with the sensitivity analyses.

**Conclusion:** The clinical evidence has shown that liraglutide is comparable if not superior to second line oral antidiabetic agents reducing HbA1c. However further clinical research may be necessary to ascertain the effectiveness of liraglutide versus insulin glargine, as there is only one trial directly comparing the two agents. Furthermore this trial comparing liraglutide to insulin glargine contained certain flaws, which may have affected the end result favoring the effectiveness of liraglutide. There are no cost effectiveness analyses that directly compares liraglutide to insulin glargine. The budget impact analysis of adding liraglutide into a state provided insurance program for low to middle income residents showed substantial increased costs.

**3-209**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Pharmacist counseling versus leaflet education in improving awareness in vitamin D deficient lebanese patients

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**Purpose:** Patient education is the cornerstone of improving the quality of life and health in asymptomatic inadequate vitamin D patients. Pharmacists play an important role in providing essential information about improving the factors that affect vitamin D levels. The purpose of this study was to determine the role of the pharmacist counseling versus leaflet education in lifestyle adjustment of vitamin D deficient patients.

**Methods:** This is a prospective, interventional, multicenter study where patients recruitment was done in two university settings. Patients above eighteen years of age with vitamin D level less than 30 ng/ml were enrolled. Exclusion criteria age above sixty five years, smokers, intake of either anticonvulsants or glucocorticoids, and with renal diseases. One peripheral blood sample was taken from each participant to check for serum 25 hydroxy vitamin D. The eligible patients then filled questionnaires that evaluated patients knowledge about: food and recommended daily intake, sun exposure, drugs and/or diseases affecting vitamin D levels where a score was given for each factor. Patients were randomly counseled either by the pharmacist or the leaflet. After the two counseling interventions, the same questions were asked and scores were given. Each participant gave a written informed consent and the Institutional Review Board (IRB) approved the study design. The statistical test used was the paired sample students T-test and data was analyzed by the SPSS.

**Results:** Patient screening took place from December 2011 till May 2012. A total of 160 patients were screened and 107 were included. All baseline characteristics were similar between the two groups. The mean 25 hydroxyvitamin D was 20.89+/- 5.02. Pharmacist counseling was more effective than leaflet intervention where the results were highly significant. The total mean of food and recommended daily intake of vitamin D of pharmacist counseling versus leaflet was 6.88 and 4.46 respectively [95 percent, CI (1.801-3.052) P equals to 0.0001], total mean of disease that affect vitamin D levels of pharmacist counseling versus leaflet were 2.79 and 1.66 [95 percent, CI(0.457-1.810), P equals to 0.0001, total mean of sun exposure of pharmacist counseling versus leaflet were 2.47 and 1.09 [CI (0.972-1.787),P equals to 0.0001], and total mean of drugs affecting vitamin D levels of pharmacist counseling versus leaflet 3.19 versus 1.97 [CI (0.430-1.999) ,P equals to 0.003].

**Conclusion:** The pharmacist role is a continuous process that includes disease prevention and treatment. The pharmacist has a very important role in providing the education about factors that might affect the level of vitamin D and providing a good awareness about the importance of life style modifications more than leaflet education.

**3-210**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Vitamin D status in healthy lebanese pharmacy students

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**Purpose:** Vitamin D a fat soluble secosteroids plays an essential role in various metabolic process and neuromuscular activities. It functions in achieving peak bone mass, maintaining muscle strength, controlling blood pressure, and regulating glucose metabolism. Bones constitute an important part of the skeletal system that requires a balanced store from vitamin D, calcium, and phosphorus. Vitamin D insufficiency or deficiency is a pandemic problem affecting all people even the young age group in the Middle East due to limited sun exposure and unbalanced diets. The purpose of this study was to estimate the prevalence of low serum 25-hydroxyvitamin D [25(OH) D ] levels in Lebanese pharmacy students.

**Methods:** A prospective, interventional, multicenter study was done on lebanese pharmacy students. A total of one hundred and sixty students, 45% males and 55% females, were studied from December 2011 till May 2012. Pharmacy students were randomly recruited from two different lebanese regions, 100 volunteers (62.5%) from sea level region and 60 volunteers (37.5%) from valley region. Patients above eighteen years of age were included and excluded if they were on anticonvulsants, glucocorticoids, and smokers. The eligible patients then filled questionnaires that included patient age, gender, weight, height, and life-style practice (type of food, and sun exposure). Each participant gave a written informed consent and the Institutional Review Board (IRB) approved the study design. One peripheral blood sample was taken from each participant by a professional medical laboratory technician, collected in special tubes, centrifuged and stored in special cooler to be sent to the laboratory for serum 25(OH) D, calcium and phosphorous measurements. The primary outcome was to indicate the prevalence of low vitamin D levels in healthy pharmacy students defined by vitamin D level < 30 ng/ml.

**Results:** There were 111 (69.3 percent) of the 160 students with low vitamin D with mean age 23.52 years. From the deficient students, there were 71 deficient females and 40 males. Mean vitamin D levels was 18.08+/- 5.38 ng/ml, calcium 9.02+/-0.47 and phosphorus was 3.33+/- 0.36. The body mass index was divided into: 10.3 percent obese, 25 percent overweight, 58.85 percent normal, and 5.9 percent underweight.

**Conclusion:** The high prevalence of low vitamin D levels showed that a high proportion of apparently healthy adults are at risk of developing musculoskeletal and other chronic diseases. The low vitamin D serum levels are due to several factors limited sun exposure, dress style,

female gender, and nutritional practice. The role of the pharmacist is essential in helping the patients recognize the potential deficiency and check the Vitamin D levels. Moreover, it is crucial to counsel the patients about replacement strategies and influencing factors.

3-211

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Clinical and economic evaluation of cholinesterase inhibitors for behavior symptom management of Alzheimers patients with implications for the Veterans Administration budget

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**Purpose:** Behavioral and psychological symptoms of dementia (BPSD) in patients with Alzheimer's disease (AD) are often considered the more challenging symptoms of the disease, and can greatly affect the patients quality of life, the caregiver burden, and the decision to place the patient into long-term care. These symptoms include irritability, anxiety or depression, sleep disturbances, agitation, delusions, and hallucinations. There are currently no FDA-approved drugs for the treatment of BPSD and this project was designed to analyze the clinical and economic evidence for the use of cholinesterase inhibitors (ChEIs) for the management of these symptoms as well as to conduct a budget impact analysis (BIA) of using ChEIs first line for the treatment of BPSD from the Veterans Administration (VA) budget holder perspective.

**Methods:** A systematic literature review of clinical and economic studies was conducted based on searches of MEDLINE, PUBMED and the Cochrane Central Register of Controlled Trials. The BIA included sensitivity analyses, which were based on the cost of ChEIs (least expensive generic ChEIs, most expensive brand ChEIs, average drug costs) and severity of AD (mild, moderate, severe). The cost saved per patient was derived from the hours of care-giving saved as result from treatment and the national average wage of AD caregivers. The total amount saved for each of the above comparators were then estimated using the number of patients with AD based on VAs statistics and prevalence data from the 2000 Census, assuming that 90% of the patients with AD would receive treatment. All costs were adjusted to 2011 dollars.

**Results:** 5 clinical studies and 13 economic studies were identified that met all inclusion criteria. Clinically ChEIs may show a benefit in the management of BPSD in patients with AD based on the significant impact on quality of life for patients and caregivers as well as the improved side effect and safety profile of ChEIs compared to other pharmacologic options. The average study length was 38 weeks (range 16-104); most studies used the Neuropsychiatric Inventory (NPI) as a behavioral outcome measure with an average decrease in NPI score of 7.8 points. The interpretation of the results is limited by the measure of BPSD most often as a secondary outcome. From an economic perspective, treatment with ChEIs shows trends of reduced cost of care specifically in terms of caregiver burden with average savings of \$2.6 billion (range \$1.9-\$4.4 billion). Treatment in all stages of AD has been shown to be potentially cost-effective by

delaying disease progression and managing BPSD. Results show that a delay in institutionalization of even as little as one month can save billions of health care dollars annually. The sensitivity analyses performed during the BIA show huge potential cost savings with ChEI use for the treatment of BPSD, ranging from \$460 million using the highest cost drug in patients with severe AD to \$4 billion using the lowest cost drug in patients with mild AD. The type of ChEI chosen due to varying costs of the medications as well as severity of the disease can all affect the amount saved. By applying census data on the prevalence of disease severity to our VA treatment population of 675,000 patients, savings could range from \$1.7 billion to \$3.2 billion based on cost of drug used for treatment. It was found that using the least expensive ChEI and starting it while the patient has mild dementia is the most advantageous budget option for the VA with a potential cost savings of \$4 billion.

**Conclusion:** Although current studies on the efficacy and safety of ChEIs are limited, there is evidence of statistically significant reductions in BPSD with treatment when compared to non-pharmacologic options or placebo. Adequate management of BPSD is linked to increased patient quality of life and decreased caregiver burden. Economic evaluations show trends in economic savings with treatment especially in respect to cost of care. This BIA, conducted from the VA budget holder perspective, indicates that treatment with ChEIs should be considered 1st line in the treatment of BPSD due to safety, efficacy, and economic considerations.

**3-212**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Student pharmacists' perceived level of confidence before and after a medical outreach elective

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**Purpose:** Standard 12 of the Accreditation Council for Pharmacy Education guidelines requires pharmacy students to be able to demonstrate population-based health care as a professional competency that must be attained prior to graduation. In accordance with these guidelines, the University of Louisiana at Monroe College of Pharmacy approved a medical outreach elective for the Spring semester of 2012. The course is structured to include 3 sections; a 12 week training and preparation phase, the week-long international outreach experience, and the post-outreach reflection. The purpose of this study was to evaluate the impact of the elective course on the students level of confidence in organizing future medical outreach opportunities and providing population-specific pharmaceutical care.

**Methods:** This study was approved by the ULM institutional review board in February 2012. Participation in the study was voluntary and informed consent was received from each student participating in the elective. A 20-question pre- and post- survey was administered to the 8 students who enrolled and completed the elective course offered in Spring semester of 2012. Thirteen questions pertained to student's level of confidence providing various pharmaceutical care components and 7 questions pertained to confidence in organizing components of medical outreach. Questions were formatted and scored based on a 5-point Likert scale (1= strongly disagree, 5=strongly agree). A Wilcoxon signed rank test was used to compare pre- and post-survey responses with an accepted  $<0.05$  considered statistically significant. Nine questions regarding the student's perceived value of the course were also included on the post-survey. Descriptive statistics were reported for these 9 questions.

**Results:** There was a significant increase in student confidence in 8 of the 20 items surveyed. Three of these items reflected increased confidence in pharmaceutical care components including, obtaining a patient history ( $p=0.03$ ), making a therapeutic recommendation to a physician ( $p=0.02$ ), and working with a multidisciplinary medical team ( $p=0.03$ ). The other 5 areas where students demonstrated increased confidence were in their ability to lead and organize a medical outreach trip ( $p<0.01$ ), identify appropriate travel medicine ( $p<0.01$ ), develop a population-based formulary ( $p<0.01$ ), purchase medications for a medical outreach trip ( $p=0.03$ ), and set up and organize a temporary pharmacy ( $p<0.01$ ). Responses to the 9 questions included only on the post-survey indicated that students perceived the course to be highly valuable. All students (100%) strongly agreed that the elective increased their awareness for the

need of pharmacists on medical outreach teams and would recommend this elective to other students. All students (100%) either agreed or strongly agreed that the elective helped them apply information learned throughout pharmacy school, made them feel more prepared for Advanced Pharmacy Practice Experiences, will help them become more well-rounded pharmacists, and was an important addition to the pharmacy curriculum.

**Conclusion:** Students involved in the medical outreach elective during the Spring of 2012 gained unique experience in providing population-based health care. The study results indicate that students completing the course had increased confidence in several areas pertaining to provision of pharmaceutical care and organizing a medical outreach trip.

3-213

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Clinical and economic evaluation of hepatitis C treatments with implications for the Veterans Health Administration budget

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**Purpose:** Hepatitis C virus (HCV) affects approximately 1.8% of the general population and 5% of the Veteran population. Of these patients, 75% will progress from acute to chronic infection. Standard of care for these patients includes an interferon based approach combined with ribavirin (IFN/RBV), which has been associated with a less than ideal achievement of sustained virologic response (SVR). In 2011, two new agents were introduced as adjunct therapy: boceprevir and telaprevir. These protease inhibitors offer a unique mechanism to help achieve SVR when added to the current standard of care but also carry a significant cost burden. The objective of this analysis was to conduct a clinical and economic evaluation of the addition of boceprevir or telaprevir to standard of care for management of treatment nave HCV genotype 1 patients. Additionally, we estimate the budget impact of HCV triple therapy from the Veterans Health Administration (VHA) perspective and assess the impact of selective treatment strategies such as IL28B guided therapy or rapid virologic response (RVR) guided therapy on clinical outcomes and cost of therapy.

**Methods:** A systematic literature review of the clinical and economic data on boceprevir or telaprevir for HCV treatment was performed. A budget impact analysis was then performed from the perspective of the VHA payer using publicly available data. Costs were estimated over a treatment period of 48 weeks, and were driven by patient eligibility factors such as genotype, contraindications to therapy, and treatment history. One way sensitivity analyses were then performed to assess uncertainties in treatment responses, clinical characteristics, and costs. Factors including population size, cost of various treatment strategies, and cost of population wide adoption of IL28B genotyping assays were evaluated for their effects on the VHA budget.

**Results:** Current evidence demonstrates the clinical benefit of protease inhibitor triple therapy in the Veteran population. Studies examining the efficacy of boceprevir and telaprevir indicated that both medications produced a higher SVR and decreased relapse rates than standard of care alone. However, therapies with each of these medications in combination with standard of care also produced a higher incidence of adverse effects such as rash (telaprevir) and anemia

(boceprevir). Prior economic evaluations concluded that addition of telaprevir or boceprevir to a standard of care regimen was cost effective, and further, that use of selective treatment strategies may offer the most cost effective option. No head to head clinical or economic analyses have been performed comparing boceprevir to telaprevir. A budget impact analysis revealed the effect of adding either boceprevir or telaprevir to current standard of care in all eligible patients was substantial and resulted in considerable VHA costs (\$2 billion and \$2.6 billion, respectively) for 57,915 patients. Sensitivity analyses revealed that the population size and acquisition cost would most significantly impact the VHA budget. Population and cost inputs were determined based on available VHA data and Federal Supply Schedule pricing. The analysis, with a range of 48,265 to 67,568 eligible patients, resulted in potential costs ranging from \$2.4 billion to \$2.93 billion for telaprevir therapy over 48 weeks or costs from \$1.78 billion to \$2.17 billion for boceprevir therapy over the same period. Selective, patient specific treatment strategies including RVR guided and IL28B guided therapies led to positive implications for both cost and efficacy.

**Conclusion:** Literature shows a benefit to the use of boceprevir or telaprevir in combination with standard of care therapy in terms of cost effectiveness and efficacy. The additional financial burden must be weighed against the added clinical benefit of triple therapy with either agent. Patient specific approaches may yield the maximum benefit for the patient and payer; however more research is needed to confirm this benefit.

3-214

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Evaluation of adherence and persistence of antimuscarinic medications for overactive bladder

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**Purpose:** Overactive bladder is characterized by urgency, with or without urgency urinary incontinence, usually with increased daytime frequency and nocturia. Treatment includes drug therapy; however, medication non-adherence is common due to unmet expectations, patient age, side effects, and therapy cost. The objective of this project was to determine the adherence and persistence to antimuscarinic medications in a managed care setting.

**Methods:** A retrospective review was conducted of adult members prescribed antimuscarinic medications between 7/1/2010-2/28/2011 and followed for 360 days after the index date. To avoid bias in the adherence calculations, the analysis reviewed members new to therapy, defined as no antimuscarinic medication within the previous 180 days. Adherence was measured using proportion of days covered (PDC), calculated as the number of days during the analysis period medication was available (total days supplied), divided by 360. The PDC was truncated at 1.00 by removing any days extending beyond the analysis period. Persistence was measured from the date of index prescription until the end of the follow-up period or date of discontinuation, whichever was first. Persistence was determined at the class level using an intent-to-treat analysis; switches from one antimuscarinic medication to another were considered persistent. Data was analyzed using iDNA (2009 Pfizer, Inc and IMS Health Inc.).

**Results:** A total of 349 members were included. Oxybutynin and tolterodine were the most frequently prescribed medications accounting for 62.2% and 18.1% of usage, respectively. The mean (+/-SD) PDC was 0.40 (0.35). A PDC greater than or equal to 0.80 at 360 days was obtained by 22.2% members. Mean (+/-SD) persistence was 108.8 (119.6) days. The percent members persistent at 90, 180, and 360 days was 37.6%, 22.5% and 10.5%, respectively. Results were compared to the IMS LifeLink Integrated Health Plan Claims database comprised of commercial, self-insured, and Medicare Advantage data. Applying the same methodology, data from this national benchmark report during 4/1/2010-9/30/2010 showed similar findings of low adherence and persistence to antimuscarinic therapy. The mean (+/-SD) PDC was 0.31 (0.32). A PDC greater than or equal to 0.80 at 360 days was obtained by 14.1% patients. Mean (+/-SD) persistence was 78.3 (101.7) days. The percent patients persistent at 90, 180, and 360 days was 25.6%, 13.6% and 7.5%, respectively.

**Conclusion:** Many members new to antimuscarinic medications discontinue therapy within the first several months of treatment. Adherence and persistence for antimuscarinic medications was

low and comparable to national benchmark reports. The results provide an opportunity for patient and provider education to support improved medication adherence.

**3-215**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Impact of pharmacist-based heart failure counseling on 30-day readmission rates

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**Purpose:** The Medicare Payment Advisory Commission (MedPAC) has identified heart failure as one of the most common, expensive and preventable hospital readmission diagnoses. Within recent years, Center for Medicare and Medicaid Services (CMS) has started to publicly report 30-day readmissions for individual hospitals and many hospitals are now focusing on reducing 30-day heart failure readmissions. The purpose of this effort is to increase transparency of every hospital, providing consumers with information to aid in their healthcare choices and to increase the quality of care while reducing costs. In 2012 CMS began implementation of the Hospital Readmissions Reduction Program which is intended to reduce hospital reimbursement based on excessive 30-day readmission rates. In order to address the readmission rate for heart failure at South Pointe Hospital, a pharmacist-based heart failure education program was piloted on two medical floors. The purpose of this study was to evaluate the effectiveness of this program on 30-day readmission rates.

**Methods:** Approval was obtained from the Institutional Review Board prior to study commencement. A pharmacist-based counseling program was initiated in October 2011. The program was initiated on two general medicine floors with one pharmacist located on each floor. The pharmacists were instructed to counsel all patients with a current diagnosis or history of heart failure. Pharmacists documented counseling sessions in one of two areas of the electronic medical record; the pharmacist intervention report or inpatient notes. The outcomes review system database was accessed in June of 2012 to determine all patients discharged to home between October 2011 and April 2012 with an ICD-9 primary diagnosis of heart failure. A retrospective chart review of each patients medical record identified whether or not a pharmacist counseled the patient on heart failure and their corresponding medications. The primary outcome of this study was to compare the 30-day readmission rates for ICD-9 primary diagnosis heart failure patients who were counseled by a pharmacist to those patients who were not counseled by a pharmacist. For the primary outcome, the chi squared test was used and an alpha value <0.05 was assigned to detect a significant difference.

**Results:** A total of 178 patients were randomly selected and included in the study from October 2011 through April 2012. There were 60 patients counseled by a pharmacist, of which 8 were readmitted within 30 days (13.3%). There were 118 patients who were not counseled by a pharmacist of which 28 were readmitted within 30 days (23.7%). The difference between the

group of patients counseled by a pharmacist and the group of patients not counseled by a pharmacist trended towards statistical significance ( $p=0.10$ ).

**Conclusion:** The results of this study demonstrate the benefit that a pharmacist education program has in decreasing 30-day readmissions for heart failure patients. A study over a longer time period and including more patients is necessary to determine a statistically significant difference.

**3-216**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Discrepancies of medication name, dose, route, and frequency in primary care clinics

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**Purpose:** Medication reconciliation is the process of reviewing a patient's medication profile, including the name, dosage, route, frequency, indication, and compliance review.<sup>1</sup> After each review, the discrepancies (defined as medications that have been inaccurately recorded or omitted in the chart record) are reconciled to prevent adverse drug events (ADE).<sup>2, 3</sup> Medication discrepancies are common. The Institute of Medicine (IOM) indicates that the process is necessary; the Joint Commission (TJC) has named medication reconciliation one of the 2010 National Patient Safety Goals.<sup>4, 5</sup> Both the IOM and TJC encourage outpatient clinics to use medication reconciliation to reduce the number of ADEs in the outpatient setting.<sup>1, 2, 6</sup> Previously published studies have highlighted the significance of medication discrepancies and ADEs in hospital settings; however, data in the outpatient primary care setting is limited.<sup>2, 3</sup> In Nassarallas et al. prospective study, a total of 65 random patients were selected from the Mayo Clinic. The study stratified the completeness of a medication list by dose, route, and frequency and focused on comparing a pre-intervention and post-intervention period. At the end of the intervention period, the completeness of the medication list among the patients increased.<sup>3</sup> Even though Nassarallas et al. studied this at only one clinic, the study emphasized the importance of medication reconciliation in the outpatient setting. By comparing paper and electronic medical records in 5 clinics, this present study reports outcomes of medication reconciliation from several clinics. The objective of the study was to compare differences in dose, route, and frequency discrepancies between electronic medical record (EMR) and paper medical record (PMR) clinics.

**Methods:** This was a cross-sectional, observational study conducted at 5 primary care clinics (3 academic and 2 community clinics). A total of 30 patients were recruited from each clinic for a total of 150 subjects in the study. Approval from UCSD Institutional Review Board was obtained before conducting the study. A systematic sampling scheme was used and patient recruitment was based on different day and time of the week. The research staff obtained consent from clinic staff members, providers, and patients at each clinic prior to the study. A research assistant followed each patient throughout the clinic visit and observed the medication reconciliation process during the visit. Subsequently, the research assistant interviewed patients about their demographics data, medication use information and the medication reconciliation process during the clinic visit: 1) after the clinic staff completed intake and before the physician entered the exam room and 2) after the physician completed the encounter with the patient. Patients were asked to recall their medication names, dosages, and frequencies. After the visit, the research assistant reviewed medical records for medications listed in the chart. Patients' interview responses were compared with the chart records (medication name, dosage, route, frequency).

We defined medication discrepancy as any difference in name, dose, route, or frequency between medications listed in the medical record and medications reported by the patient. All analyses were performed using Stata, version 11.0 (StataCorp LP, College Station, Texas). Continuous variables were compared using the Students t-test, and categorical data were compared using Chi-square test. The two groups (EMR and PMR) were compared to determine whether there was a difference in descriptive characteristics and medication discrepancies. A p-value of 0.05 was used to determine statistical significance.

**Results:** For the 150 patients, 1,238 medications were collected from both the EMR and PMR clinics. Specific discrepancies for the medications recorded in the medical records and reported by patients, EMR clinics ranked superior with only 24% of medications having at least one discrepancy of dose, route, or frequency while the PMR clinics had 40% of medications ( $p<0.001$ ). The use of EMR resulted in less dose and frequency discrepancies, specifically with dose discrepancy at 12% for EMR and 23% for PMR ( $p<0.001$ ) and frequency discrepancy at 5% for EMR and 14% for PMR ( $p<0.001$ ). The route discrepancy shows that PMR ranked better than EMR with 2% and 4%, respectively ( $p<0.004$ ).

**Conclusion:** Primary care clinics that use EMR have statistically less discrepancies in medication name, dose, route, and frequency when compared to clinics that use PMR. With these preliminary data, future studies can focus on classes of medications resulting from medication discrepancies in order to help clinical investigators design intervention tools to minimize such discrepancies.

3-217

**Category:** Small and Rural Pharmacy Practice

**Title:** Pharmacist usage of a medication intervention sheet for nitrofurantoin, metformin, and trimethoprim/sulfamethoxazole(sm<sub>x</sub>-tmp) in a small rural community hospital.

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**Purpose:** All patients who receive nitrofurantoin will have an estimated creatinine clearance (ecrcl) of at least 60 ml/min. Patients who take metformin will not have an elevated serum creatinine (scr), and patients on sm<sub>x</sub>-tmp will have their dosage renally adjusted.

**Methods:** A medication intervention sheet for the pharmacist management of three drugs, nitrofurantoin, metformin, and sm<sub>x</sub>-tmp, was developed and approved by the pharmacy and therapeutics committee (P and T) in November 2010. This sheet requires a scr, height, weight, and age. The calculated ecrcl is used to guide nitrofurantoin and sm<sub>x</sub>-tmp, and the scr is used for metformin monitoring. When a patient's ecrcl is less than 60 ml/min, nitrofurantoin therapy is discontinued. When patients on metformin have a scr of 1.5 or higher for males or 1.4 or higher for females, metformin is discontinued. If the ecrcl is less than 15 ml/min during sm<sub>x</sub>-tmp therapy, it is discontinued. If the ecrcl is between 15 ml/min and 30 ml/min, then one double-strength tablet of sm<sub>x</sub>-tmp is given daily. If the ecrcl is 30 ml/min or higher, then the normal adult dose of one double-strength of the sm<sub>x</sub>-tmp is given twice a day. When a dosage adjustment is needed, the medication intervention sheet is completed by the pharmacist and sent to nursing where the hospitalist can either accept or reject the recommendation.

**Results:** The impact of this intervention tool is reflected in the decreased utilization of these three drugs. In 2010, seven unit dose boxes of 100 nitrofurantoin 50mg capsules were purchased, whereas only one box of 100 was purchased in 2011. Ten boxes of metformin 500mg unit dose were bought in 2010 as compared to six in 2011. The purchases for sm<sub>x</sub>-tmp dropped from twelve boxes in 2010 to eight boxes in 2011. The decreased utilization has also helped realize a \$273 savings in acquisition costs. The cost per adjusted patient day also decreased from \$.016 in 2010 to \$0.003 in 2011 for nitrofurantoin, from \$0.023 in 2010 to \$0.014 in 2011 for sm<sub>x</sub>-tmp, and from \$0.01 in 2010 to \$0.007 in 2011 for metformin 500mg. An analysis of the intervention sheets shows a 100% acceptance rate for sm<sub>x</sub>-tmp, 89% acceptance rate for nitrofurantoin, and a 82% acceptance rate for metformin with an overall acceptance rate of 90%.

**Conclusion:** Pharmacist interventions have helped promote the proper utilization of nitrofurantoin, sm<sub>x</sub>-tmp, and metformin.

3-218

**Category:** Small and Rural Pharmacy Practice

**Title:** Efforts to reduce clostridium difficile infections in a rural community

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**Purpose:** Recently increases in clostridium difficile (c-diff) infections reached outbreak proportions both in the community and the hospital and we wanted to explore possible avenues to reduce the incidence of c-diff in our community.

**Methods:** We utilized a multi-faceted approach: We obtained the necessary laboratory equipment to rapidly identify c-diff cases more accurately using polymerase chain reaction (PCR). We prepared an informational packet that was distributed to community physicians offices containing the newest treatment recommendations from the Society for Healthcare Epidemiology of America (SHEA), recommendations for testing by PCR and a patient education brochure. We authored a short article for the physician's newsletter that included the episodal and severity index treatment grid released by SHEA. A presentation was given at physician committees with 12 months of data on antimicrobial usage in the hospital, the increase in c-diff infections (community and hospital), and treatment suggestions for c- diff infections. Community education sessions were presented to local long term care facilities, assisted living centers, home health agencies, and rehabilitation facilities regarding the increase in community burden, recommendations for testing by PCR, and the recent appearance of the NAP-1 strain in our community. We developed a system within the electronic medical record (EMR) to notify medical personnel about c- diff infections, the dates of onset and the number of episodes the patient had experienced to aide in determination of the best treatment options according to the latest guidelines. Our EMR system is accessible from the offices of community physicians, on-site at long term care facilities, and during hospitalization by all health care practitioners. We worked with our Clinical Information Department to make a c-diff care set available in the Cerner system to suggest c-diff treatment options based on the number and severity of the episode(s). Brochures were developed (in English and Spanish) for families and visitors on contact transmission based precautions to increase compliance through education. Included were instructions on the proper donning and doffing of personal protective equipment. Informational brochures were developed and distributed to patients diagnosed with c-diff infections and to certain high-risk populations being discharged from our acute care facility. These brochures provide additional information and education for interventions at home to minimize the risk of transmission and re-infection.

**Results:** Information packets were distributed to more than 20 community physicians outlining treatment recommendations, patient education, appropriate PCR testing and describing factors that contribute to c-diff infections, e.g., overuse of antibiotics, the use of certain antibiotics and

the growing evidence of adverse effects when co-administered with proton pump inhibitors. When a patient is c. diff positive, based on the newly implemented PCR test, we note that information in the Cerner EMR system. To date nearly eighty patient charts have been tagged representing infections in the community since January, 2012. Our Cerner system is used not only on the hospital campus but in community physician's offices and the long term care facilities in our community. The c- diff order set offers best practices treatment suggestions and information about the patients c- diff episode status. To date at least thirty physicians can utilize this care set.

**Conclusion:** Improved communication of the patients c. diff status will allow for faster and more appropriate treatment not only in the hospital but community wide. Prevention of recurrence and guidelines for correct treatment of c- diff episodes can reduce hospitalizations, decrease the severity of the episode and impact the length of the hospital stay. So far providers in the hospital and the community, area nursing homes, home health agencies, rehabilitation centers and the hospital infection preventionist have received information about c-diff prevention and current recommended treatment options. By working together we hope to reduce the incidence and severity of c-diff in our community.

**3-219**

**Category:** Small and Rural Pharmacy Practice

**Title:** Trends in pharmacy practice in Illinois small and rural hospitals over the past two decades

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**Purpose:** The objectives of the study were to describe pharmacy practice in small and rural hospitals in Illinois in 2011 and to examine changes that have occurred over time.

**Methods:** A questionnaire was developed and modeled after similar surveys conducted in 1991 and 2001, with certain questions revised or added to make the tool more relevant to contemporary practice. The questionnaire was designed to identify and quantify the provision of pharmacy services in these hospitals, including the drug distribution system and services, clinical pharmacy services, and human resources and staffing. A list of small and rural hospitals published by the Illinois Hospital Association was used to identify the hospitals for inclusion in the mail survey. This list was cross-checked against the Illinois Department of Financial & Professional Regulation (IDFPR) pharmacy licensure database. The study was approved by the institutional review board of the University of Illinois at Chicago. The mail survey was administered from November 2011 through February 2012. Data obtained from usable responses were entered and saved using commercially available database management software (Microsoft Access and Excel, Microsoft Corp., Redmond, WA). Statistical software was used to generate descriptive statistics to characterize the respondents (SAS 9.2, release 03.08, San Antonio, TX). All results were expressed in terms of usable responses for each question or item.

**Results:** The response rate was 46.5% (40/86 usable responses). Respondent hospitals had a lower average daily census (31.6) compared to years 2001 and 1991. The primary structure of the hospital drug dispensing system was central pharmacy (57.1%), followed by a hybrid (37.1%), and then by decentralized pharmacy (5.7%). The most commonly used form of technology reported was patient-specific automated drug dispensing cabinets, which was present in 68.4% of hospitals compared to 34.8% of hospitals 10 years ago. The percentage of rural hospitals in Illinois providing patient-specific clinical pharmacy services increased in 2011 compared to 2001. In fact, increases were seen for each type of clinical pharmacy service queried except investigational drug services. The largest increases compared to 2001 were in the provision of compliance and drug histories, i.e., medication reconciliation (69.2% v. 46.8%) and medical emergency response (82.0% v. 34.0%). The vacancy rates in 2011 were 2%, 2.9%, and 2.3% for pharmacists, support-staff, and overall. There was a substantial decline in the vacancy

rates in 2011 compared to 2001 (except for support staff). The pharmacist vacancy rate decreased markedly from 14% in 2001 to 2% in 2011.

**Conclusion:** The use of clinical pharmacy and the application of medication-related technology in small and rural hospitals in Illinois have gradually expanded over the past two decades. Among the most significant reverse trends during the past 20 years is the decreased pharmacist vacancy rate and overall vacancy rate.

**3-220**

**Category:** Toxicology

**Title:** Retrospective analysis of the prevention and treatment of alcohol withdrawal at a large community teaching institution

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**Purpose:** Alcohol withdrawal in hospitalized patients can increase length of stay, morbidity and mortality. Assessment scales, such as the Clinical Institute Withdrawal Assessment (CIWA) scale, exist to facilitate preventative strategies for patients with a history of alcohol abuse. The purpose of this study was to evaluate the assessment, prevention strategies and treatment of alcohol withdrawal.

**Methods:** The institutional review board approved this retrospective chart review of patients admitted to the hospital with a history of alcohol abuse as identified by the surrogate marker of the ordering of an intravenous infusion of thiamine, folic acid and multivitamins (rally pack). Data was collected on age, sex, alcohol history, CIWA scale utilization, CIWA score upon admission, highest CIWA score during stay, length of stay and the development symptoms of alcohol withdrawal, as defined by the Diagnostic and Statistical Manual (DSM) IV.

**Results:** A total of 100 patients were evaluated in this study. The average age was 58 years and 75 percent of patients were male. Sixty-four percent of patients were categorized as heavy abusers of alcohol (more than 2 standard drinks per day for men and more than 1 standard drink per day for women). Globally, the CIWA protocol was utilized appropriately in 30 percent of patients. Fifty-three percent of patients with a history of alcohol abuse developed symptoms of withdrawal and 21 percent of patients exhibited a rise in CIWA scores during admission. The most common symptom of withdrawal was autonomic hyperactivity (47 percent), followed by tremor (34 percent). Management of symptoms primarily included lorazepam (69 percent) or chlordiazepoxide (29 percent). Six patients required transfer to the intensive care unit for management of alcohol withdrawal symptoms and average length of stay for all patients was 7 days (range 1-49 days).

**Conclusion:** Given the low appropriate utilization of the CIWA protocol, education should be given on appropriate screening and compliance with the protocol. A significant percentage of patients developed symptoms of alcohol withdrawal; therefore the protocol should be reassessed for lower breakpoints for medication administration as well as the consideration for routine benzodiazepine therapy.

3-221

**Category:** Toxicology

**Title:** Arizona poison and drug information center (APDIC) quality improvement project: quality assurance guideline to monitoring and improving recording errors (QUAGMIRE)

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**Purpose:** Minimizing errors in case note documentation and coding in the Arizona Poison and Drug Information Center (APDIC) electronic medical record is essential to assure all necessary, accurate information is uploaded into the National Poison Data System (NPDS). NPDS is part of a national network to provide rapid response to infectious disease outbreaks and public health emergencies. NPDS only uploads the pre-programmed codes or check boxes with common clinical effects and therapies related to the cases. While errors will always occur with documentation, it is important to emphasize the completeness of the initial case documentation and to reduce errors in the transposition of these notes into codes. This quality improvement project aimed to remedy these errors through standardization of documentation.

**Methods:** A retrospective analysis of APDICs electronic medical record was conducted. We looked at exposure cases reported by healthcare facilities during January and December 2011 for number of coding errors. We also looked at the number of cases that included blood pressure (BP), pulse and temperature as a measure of completeness. Then we modified the basic SOAP note to create a standardized documentation case notes form applicable to APDIC pharmacists. We allotted two weeks for the pharmacists to start using our new form before collecting any post-data. Post-implementation data was collected for a total of four weeks looking at these same variables. A chi-square analysis was performed for both pre and post-intervention stages with an alpha a priori of 0.05.

**Results:** Prior to implementation, we found 55 errors in 248 cases (22%). In addition, we found that BP was recorded in 95 cases (39%), pulse in 100 (40%), and temperature in 18 (7%). After our two-week implementation phase, we found 23 errors in 165 cases (20%,  $p=0.7$ ). We found that blood pressure was recorded in 39 cases (34%,  $p=0.37$ ), pulse in 45 (39%,  $p=0.76$ ) and temperature in 10 (9%,  $p=0.5$ ). Among the coding errors found, electrolyte irregularity, conduction disturbance, ECG change and hypertension were the most common. These were clinical effects noted in the case note documentation area, but were not transposed into the codes area.

**Conclusion:** Our standardized case documentation form did not significantly decrease the number of coding errors. In addition, we did not see an increase the number of cases in which BP, pulse and temperature were recorded. A follow up study focused on the training of new pharmacists or pharmacy residents could show more insight to reducing errors by standardized documentation procedures.

**5-001**

**Category:** Automation / Informatics

**Title:** Transition to a Paperless Clinical Monitoring Process to Support Pharmacy Practice Model Changes

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**Purpose:** The highlight of the Pharmacy Practice Model Initiative (PPMI) summit in November 2010 was focused on developing a more patient centered care model. At Cleveland Clinic Florida (CCF) our organizational structure followed the specialist model where each clinical specialist only reviewed and monitored their specific service. Clinical specialists used both paper and electronic monitoring tools that were not consistent among practitioners. In August 2011, CCF transitioned to a patient centered model for pharmaceutical services. The goal of the new practice model was to ensure every patient admitted to the inpatient setting was monitored by a clinical pharmacist. A standardized electronic monitoring and documentation tool was created to facilitate the workflow. Standard productivity metrics were identified to evaluate the impact of the new practice model.

**Methods:** In August 2011, pharmacists practice was transitioned to unit based versus clinical service based with each pharmacist responsible for the clinical services for their area. Core clinical services included nutrition support, anticoagulation monitoring, antibiotic stewardship, pharmacokinetic monitoring, discharge counseling, and specialized patient education. Several changes were made to the daily workflow for clinical services. These changes included using shared clinical dashboard, removing paper monitoring forms, electronic handoff process, standardizing daily electronic progress notes, and standardized intervention documentation. Each pharmacist was trained to follow a consistent method of clinical documentation. Additionally, a pharmacy technician was added to the decentralized pharmacy group to provide discharge prescription services to all patients prior to discharge. To evaluate these changes, total number of interventions per month from January 2011 to April 2012 was reported. Discharge prescription volume generated from hospital discharges were tracked from August 2011 to April 2012.

**Results:** The mean number of interventions increased from 3,126 per month before implementation to 4,322 per month after implementation of the patient centered model. The mean number of interventions per patient-day increased from 0.84 to 1.14, respectively. Approximately forty percent of all discharge prescriptions were filled in-house prior to the patient leaving the hospital.

**Conclusion:** Implementation of a standardized, electronic monitoring and documentation tool to support practice model change resulted in an increased monthly interventions at our facility. Volume of discharge prescriptions generated from the discharge program supported the addition of a full time pharmacy technician.

**5-002**

**Category:** Automation / Informatics

**Title:** Implementing an electronic chemotherapy status board (eCSB) to improve communication and decrease patient wait times

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**Purpose:** Communication between nursing and pharmacy staff plays an important role in the preparation and administration of chemotherapy in an ambulatory oncology infusion center. The nursing staff relies on the status of the chemotherapy to coordinate timing of premedications and determine the workflow for initiation of other patients' treatments. Nurses may also inquire on the status of the chemotherapy preparation on behalf of a waiting patient. While the need for the status updates is essential, each inquiry results in an interruption to the pharmacy staff preparing the chemotherapy, which can subsequently result in increased preparation time, potential order review and compounding errors, and decreased patient satisfaction. An electronic chemotherapy status board (eCSB) was developed to provide a communication tool that meets the need for status tracking while minimizing pharmacy interruptions.

**Methods:** A team of pharmacists and pharmacy information systems specialists developed and implemented an electronic chemotherapy status board (eCSB). The system was designed so pharmacy and nursing staff can update and monitor the status of a patient's chemotherapy. The status board consists of two secure interactive web pages, both using an industry standard suite of technologies. Training, conducted by pharmacy staff, took place prior to implementation. To initiate a treatment request, the nurse logs onto the secure web page and then enters the patient's name and date of birth into the required fields; the system will auto complete these fields pulling data from our admissions system, or the information can be manually entered. After selecting the ordering nurse's name from a drop down list, they click the "ADD" button to send the electronic request to the pharmacy. The pharmacy team communicates with the nursing staff by providing status updates to each patient's treatment request as it moves through the preparation process. Pre-formatted status updates, created by pharmacy staff, are selected from a drop down menu. Status updates include: entering new order, in process, paged physician; pending clarification or approval and in transit. After delivery of the chemotherapy, the status is changed to delivered and the nurse is notified electronically, minimizing interruptions. Real time and historical data is maintained on a data server and can be reported on by a variety of applications such as a standard spreadsheet, database applications and other interactive web pages. Daily data collection includes the number of patients treated, how long the preparation and delivery process took and any reasons for delay that were communicated to the nursing staff. Reports, tables and charts are generated from this data used to analyze trends.

**Results:** The electronic chemotherapy status board was implemented in March 2011 and is currently being used by nursing for all status-related inquiries. Acceptance is high by both pharmacy and nursing staff. Reports generated from data collection are able to identify peak times and high volume days. Pharmacy management receives volume alert emails and is able to monitor the work queue and allocate additional resources during peak times. Utilization of this system has resulted in decreased turnaround times: Pre-implementation average turnaround was 40 minutes; 1 year post was 30 minutes. Minimizing the amount of interruptions has allowed for an 11.2% increase in the number of doses delivered in less than 45 minutes.

**Conclusion:** Utilization of an electronic status board improves communication between nursing and pharmacy staff and decreases interruptions by providing real time electronic status updates. Pharmacy staff is able to provide safe and effective treatments while maintaining efficiency and minimizing the time demand on the patient.

**5-003**

**Category:** Automation / Informatics

**Title:** Concordance with prescribing indications entered into the computerized prescriber order entry (CPOE) system

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**Purpose:** The CPOE system can serve as a valuable data repository for information on medication use. Incorporating mandatory entry of prescribing indications into CPOE and utilizing the systems electronic reporting capabilities to efficiently extract this data hospital wide can be a key strategy for large scale quality monitoring. Reliability of the CPOE systems prescribing indication data should be determined prior to using for widespread drug use monitoring. The purpose of this study was to evaluate the reliability of electronic prescribing indication data entered into the CPOE system at a large tertiary care centre.

**Methods:** The institutional review board approved this retrospective chart review. At our institution, prescribing guidelines have been built directly into the CPOE system to promote rational medication use. A mandatory field displays during order entry requiring the clinician to select a prescribing indication or enter free text if an individual patients clinical circumstance warrants deviation from the recommended. A retrospective audit of 220 patients with 272 courses of therapy was conducted. Documentation in clinical notes, nursing flow sheets, medication histories, microbiology, radiology, and other laboratory results were reviewed to determine true prescribing indications. A customized electronic report was created from the CPOE system to extract hospital wide orders with their prescribing indications for a one month period. An order was deemed concordant if the prescribing indication entered into the CPOE system accurately reflected the patients true clinical situation as reflected in chart documentation. An order was deemed adherent if prescribing indication entered into the CPOE system was within established hospital guidelines. The primary measure was overall hospital wide percentage of concordant orders. Secondary measures included percentage of orders non adherent to established hospital guidelines, and the percentage of concordant orders within the non-adherent group.

**Results:** Overall hospital concordance was 88% (N=272). Overall hospital adherence to prescribing restrictions was 65% (N=272). Within the orders not adhering to hospital restrictions, concordance was 93% (N=95).

**Conclusion:** The data shows that the CPOE systems prescribing indication data at our institution is associated with high levels of concordance and is reliable. Orders not adhering to established

hospital guidelines were associated with 93% concordance indicating that although a large number of orders were prescribed for indications outside of hospital guidelines, prescribing indications entered into the CPOE system for those orders were accurate. Institutions with CPOE systems should consider integration of prescribing guidelines into the electronic medication ordering process through mandatory entry of prescribing indication and evaluate the data's reliability. Electronic reporting of prescribing indication data can be a useful tool to enhance efficiency of large scale drug use monitoring.

**5-004**

**Category:** Automation / Informatics

**Title:** The impact of computerized provider order entry (CPOE) on adverse events as measured by the Institute for Healthcare Improvement (IHI) Global Trigger Tool

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**Purpose:** CPOE has been reported to decrease the rate of adverse drug events (ADEs) and various methods have been employed to detect ADEs. The purpose of this study is to determine the impact of CPOE on ADEs and adverse medical events (AMEs) using the Institute for Healthcare Improvement Global Trigger Tool.

**Methods:** The institutional review board approved this retrospective, pre and post comparison of ADEs and AMEs as measured by using the IHI Global Trigger Tool around the implementation of CPOE. Two three month periods representing before and after implementation of CPOE in the first three hospitals to go live with CPOE in a seven hospital health system were compared. A total of 360 randomly selected charts were evaluated using a modified version of the IHI Global Trigger Tool before and after the implementation of CPOE. Triggers were identified and assessed to determine if they represented an adverse event by a team consisting of pharmacists, a nurse and a physician adjudicator. Adverse events were classified as an AME or ADE by the team. Poisson regression models with an exposure constraint for total patient days were employed to compare the difference between the per patient day incidence rate of AMEs and ADEs before and after the implementation of CPOE, while controlling for age, gender, all patient refined (APR) diagnosis related groups (DRGs) weight and major diagnostic category (MDC), hospital and an array of electronic triggers. A difference of approximately two standard errors or more in the incidence rate ratio (IRR) was considered to be statistically significant.

**Results:** Total adverse events (181 vs 128), AMEs (136 vs 91) and ADEs (45 vs 37) decreased in the 360 charts reviewed pre implementation of CPOE compared to the 359 patient charts reviewed post implementation of CPOE (one post CPOE case was invalidated). Length of stay (average patient days) fell from 8.2 days pre CPOE to 7.3 days per patient post CPOE. Thus, the incidence rate was 0.015 ADEs per patient day pre-CPOE and 0.014 post CPOE, for an unadjusted incidence rate ratio (IRR) of 0.92 or an 8 percent decline in the daily rate of ADEs. The comparable IRR for AMEs was 0.75. However, only the difference in AME rates achieved statistical significance. The adjusted post to pre incidence rate ratio from the Poisson regression model was 0.68 representing a decrease of 32 percent in the adjusted daily per patient rate of

AMEs (95 percent confidence interval 0.49 to 0.94,  $P = 0.021$ ). Comparable adjusted figures for ADEs were an IRR of 0.84 (95 percent confidence interval 0.50, 1.39,  $P = 0.495$ ).

**Conclusion:** A statistically significant reduction in AMEs in a three month period of time occurred after the implementation of CPOE compared to before CPOE as measured by a modified version of the IHI Trigger Tool. A statistically significant change in ADEs was not detected.

**5-005**

**Category:** Automation / Informatics

**Title:** Pilot study results of an automated system preparing intravenous admixtures in a hospital pharmacy aseptic unit

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**Purpose:** A compounding robot was installed in a Spanish hospital pharmacy aseptic unit. Currently, the effect of automation of intravenous drugs preparing process is unknown. The purpose of this study is to describe and analyze pilot study results of a compounding machine in terms of accuracy and efficiency.

**Methods:** Prospective descriptive pilot study of automated compounding intravenous admixtures in a Spanish pharmacy hospital aseptic unit for six months. The intravenous preparations procedures entered into the robot database were: Caspofungin (caspofungin 50 mg and 70 mg in 100 mL and 250 mL of saline, respectively) and Morphine (Morphine 100 mg in 100 mL and 200 mL of saline). The following parameters were analyzed in terms of accuracy: total number of intravenous admixtures prepared by the robot, percentage of right and wrong preparations, correct number of preparations classified according to accuracy percentage of the real dose (defined on the software robot) with respect to theoretical dose. The accuracy rates (%) were defined by the following ranges (absolute value): less or equal than 1%, more than 1% and less or equal 3%, more than 3% and less or equal 5% and more than 5%. As for the efficiency of the automated process, it was evaluated calculating the average manual time loading of vials and consumables on the machine, the average time of reconstitution lyophilized powders (caspofungin) and automated dosing process, and the total time of automated compounding, defined as manual load time plus average time of reconstitution and dosage.

**Results:** From December 2011 to May 2012, the automated device prepared a total of 622 preparations, being correctly at first 92.4%, and 7.6% had to be reprogrammed on the machine, due to failures in the automated developing process. 100% of the preparations were administered to patients. Dose rate accuracy on correct preparations was: less or equal 1%: 350 preparations (caspofungin: 118; morphine: 232); more than 1% and less or equal 3%: 143 preparations (caspofungin: 82; morphine 61); more than 3% and less or equal 5%: 82 preparations (caspofungin: 50; morphine: 32); more than 5%: 0 preparations. The reasons for reprogramming were faulty performance of the automated process (physical parameters of use of vials and consumables, inexperience with robot use and lack of some features in the device software). To overcome these problems, we proceeded to the reassignment of physical variables of vials and

consumables, device management optimization and device software upgrade. The average time for manual loading of vials and consumables was 1.15 minutes. The average time for the automated reconstitution and dosing process was 4.71 minutes for caspofungin and 2.69 minutes for morphine. Total time for caspofungin and morphine automated compounding were 5.86 and 3.84 minutes respectively.

**Conclusion:** In the pilot study of a compounding robot for intravenous admixtures in a Spanish hospital pharmacy aseptic unit, 100% of them were prepared with high accuracy. The results obtained after the pilot study showed that automated compounding process is safe and efficient, so it will lead to expansion of the number of pharmacy-prepared sterile products prepared by the robot.

**5-006**

**Category:** Automation / Informatics

**Title:** Evaluation of Effectiveness of Real Time Outpatient Pharmacy Printing of Savings Estimation for Patients with Mail Order Incentive

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**Purpose:** Maximizing utilization of mail order pharmacy services has been shown to improve organizational efficiency, cost effectiveness, patient satisfaction and medication adherence. However, patients often lack knowledge of the process and benefits of ordering their prescriptions through mail order. A process was created to electronically send a real time message via HL7 interface to a pharmacy printer at time of prescription dispense, which results in the printing of a handout describing the mail order process and which provides a patient specific estimated savings for patients with a co-pay incentive to use mail order. The purposes of this study were: 1) to examine the efficacy of the flyer in increasing utilization of mail order services and 2) to identify patient specific characteristics associated with a positive response to the outreach.

**Methods:** The institutional review board approved this retrospective study of patients, 18 years and older, who were continuously enrolled at Kaiser Permanente Southern California (KPSC) between August 2010 and May 2012 and who received a chronic medication between August 2010 and July 2011, but did not utilize mail order pharmacy services during that time and did not have a mail order co-pay incentive. Patients who received a chronic medication between August 2011 and November 2011 were divided between those that received a mail order incentive flyer and those that did not. The mail order incentive flyer printing program was initiated with a pilot that began in August 2011 and was rolled out in phases throughout the 128 pharmacies in Kaiser Permanente Southern California region during this time. Receipt of the flyer was tracked electronically as the print messages were sent to the pharmacy printers. Use of mail order services was measured between December 2011 and May 2012. The primary outcome was percent of members in each group with positive response defined as patient receipt of at least 1 mail order prescription during this time. A multivariate logistic regression was done to compare patient characteristics to determine if any characteristics were associated with a more positive response. The characteristics evaluated were, age, gender, ethnic/racial classification, and total prescription utilization.

**Results:** Among the 213,515 patients that met the criteria to be included in the study, 62,561 (41.4%) received the mail order incentive flyer during the study period. Mail order services were utilized in the follow-up period by 10.8% of the patients who received the mail order incentive flyer and 9.8% of the patients who did not receive the flyer ( $P < 0.001$ ), a 9.2% difference in

response (Odds Ratio: 1.103; 95 percent CI 1.070-1.137,  $p < 0.001$ ). The results of the multivariate regression showed that those using mail order services at a higher rate in the follow-up period were female vs. males (Odds Ratio: 1.159; 95 percent CI 1.126-1.193,  $p < 0.001$ ), aged less than 65 vs. aged 65 and older (Odds Ratio: 1.121; 95 percent CI 1.084-1.159,  $p < 0.001$ ), Asians vs. Non-Hispanic Whites (Odds Ratio: 1.128; 95 percent CI 1.072-1.186,  $p < 0.001$ ), and those receiving more than 6 prescriptions in the study period vs. those on only 1 prescription (Odds Ratio: 1.050; 95 percent CI 1.003-1.100,  $p = 0.014$ ). Those using mail order services at a lower rate in the follow-up period were Non-Hispanic Blacks vs. Non-Hispanic Whites (Odds Ratio: 0.688; 95 percent CI 0.652 -0.726,  $p < 0.001$ ) and Hispanics vs. Non-Hispanic Whites (Odds Ratio: 0.683; 95 percent CI 0.657 -0.710,  $p < 0.001$ ). Patients who received between 2 and 6 prescriptions during the study period were statistically no more likely to use mail order than those with 1 prescription.

**Conclusion:** Printing of a mail order incentive flyer describing the process of ordering mail order prescriptions and providing a patient specific estimation of mail order incentive co-pay savings does improve utilization of mail order pharmacy services in those members on chronic medications with a mail order incentive benefit who have not used mail order pharmacy services in the previous 12 months. The increase in mail order utilization appears to be higher in females, those under 65 years of age, those of certain racial/ethnic groups, and those who have received the most prescriptions. There may be opportunities to selectively target certain groups for improved response.

**5-007**

**Category:** Automation / Informatics

**Title:** Use of an internet-based education management system to track ICU pharmacists interventions.

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**Purpose:** For many colleges and schools of pharmacy, one role of the office of experiential education is to promote preceptor and practice site development. Over 90 colleges and schools of pharmacy use the same commercially available internet-based data management platform to support education and evaluation of pharmacy students. This platform includes a web and mobile-based logging component used to document patient encounters, interventions, drug-related problems, and drug lists to track students interventions and activities as they progress through experiential coursework. The software allows for on-demand generation of reports for specified time periods or interventions. Because the platform is so widely used in pharmacy education, it provides a unique resource for preceptor support and site development for institutions and pharmacists who collaborate with pharmacy schools within their region. We have recently piloted the use of the electronic logging platform for data collection and reporting for pharmacists in two intensive care practice sites (MICU, Burn). This project was designed to demonstrate the utility of this software to record practice-based interventions by pharmacists or preceptors independent of student documentation/evaluation functions.

**Methods:** A panel of three ICU pharmacists developed a list and documentation form for 33 different interventions. Two pharmacists (one MICU, one Burn ICU) recorded interventions and time spent during daily rounds in the electronic data log. Records documented for a six-month period are described. Participants evaluated the ease of use and utility of the documentation method using a 5-item Likert scale (1=strongly disagree to 5=strongly agree). Mean values are reported. The types of interventions logged by each pharmacist were also analyzed to determine which interventions were most common in each setting.

**Results:** The number of interventions and average time on daily rounds reported were 1089 and 3.3 hours (MICU) and 376 and 1.1 hours (Burn), respectively. The top four interventions (site-number) were the same for both sites [drug added (MICU-277, Burn-138), drug discontinued (MICU-237, Burn-110), dose-adjustment (MICU-203, Burn-57), and monitoring recommendation (MICU-172, Burn-33)]. The average daily census was 16 (MICU) and 10 (Burn) patients, respectively. Participants indicated the electronic documentation tool has increased their ability to objectively document interventions (5.0) and time and effort (5.0) and

was easy to: understand (4.0), incorporate into clinical responsibilities (4.5), and use for reporting (4.0). Additionally, participants report plans to use the platforms reporting functions to provide supporting documentation for annual assessment of clinical responsibilities.

**Conclusion:** The electronic data management platform evaluated is widely employed in colleges and schools of pharmacy. The logging component of this platform can provide a unique source of preceptor support and site development for institutions and pharmacists who collaborate with these schools. Because the platform allows for customization of interventions/activities documented, any practice site with internet access may be able to implement use of the logging tool to document pharmacists activities. The ability to generate tailored reports on demand allows rapid response to questions regarding pharmacists contributions and provides data to support evaluation of their impact in a patient care area, cost-savings initiative, or national patient safety goals.

**5-009**

**Category:** Cardiology / Anticoagulation

**Title:** Monitoring achievement of adequate heparin levels in adult patients receiving heparin infusions: a drug use evaluation of an adult weight based heparin infusion protocol

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**Purpose:** The Joint Commission National Patient Safety Goal (NPSG) 03.05.01 requires that health care organizations evaluate anticoagulation safety practices, take action to improve practices, and measure the effectiveness of those actions. In 2005, our hospital instituted a new adult patient weight based heparin infusion protocol to monitor and adjust heparin dosage using anti-Xa levels rather than the prothrombin time. The protocol was updated in February 2009, followed by an evaluation to assess protocol efficacy. Research reported in the literature indicates that patients who do not achieve adequate levels of heparin in the first 24 hours are at increased risk for recurrent thromboembolic events. The purpose of this evaluation was to determine if the dose adjustment algorithm in our adult weight based heparin infusion protocol safely provides our patients with adequate heparin levels within the first 24 hours of the infusion.

**Methods:** The hospital institutional review board approved our evaluation as a retrospective chart review. A total of 452 patients for whom a heparin infusion protocol was ordered during the period of July 2011 through February 2012 were identified using the McKesson Horizon Meds Manager software system. Exclusion criteria included patients undergoing an invasive procedure during which the heparin infusion was interrupted within the first 24 hours, patients who had a heparin infusion for less than 24 hours without achieving adequate anti-Xa levels, and patients receiving medications that affect the anti-Xa level prior to heparin infusion. The final number of patients for study inclusion was 312. Our adult weight based heparin infusion protocol includes options for both general and acute coronary syndrome (ASC) indications. For each indication there is an option for heparin bolus administration. The initial bolus for our general protocol is 80 units per Kg with a maximum of 10,000 units and an initial infusion rate of 18 units per Kg per hour with a maximum of 2,000 units per hour. The ACS protocol has an initial bolus of 60 units per Kg, with a maximum of 4,000 units and an initial rate of 12 units per Kg per hour with a maximum rate of 1,000 units per hour. Tricore Reference Laboratories has established therapeutic range for heparin infusions at 0.3 to 0.7 anti-Xa units per ml. Therefore, an adequate anti-Xa level per our protocol would be greater than or equal to 0.3 anti-Xa units per ml. Our dose adjustment infusion algorithm has a maximum actual patient body weight of 125kg. The primary objective was to determine if the percentage of our patients who attained adequate heparin levels within the first 24 hours compares favorably to levels reported in the literature. An additional goal was to determine if a statistical difference in anti-Xa levels exists between the

patient subgroup weighing 125kg or more and patients whose weight falls below the dosing cap in our algorithm within the 24 hour study period. The investigators also wanted to discover the number of patients within our included population achieving anti-Xa levels greater than or equal to 0.3 anti-Xa units per ml, but not less than 0.81 anti-Xa units per ml within the first 24 hours. Above this level, our algorithm instructs the nurse to hold the heparin infusion then restart the infusion at a reduced rate. Both pharmacy and nursing staff in our hospital agree that holding the infusion increases both the likelihood of fluctuating levels and inaccuracies in following the algorithm. Finally, our rate of major bleeding, defined as the need to infuse red blood cells within the first 24 hours of heparin infusion due to a documented adverse drug event involving the heparin infusion was compared to literature reports.

**Results:** The percentage of patients attaining adequate anti-Xa levels was 97.4 percent, comparable to the 97 percent reported in the literature. There was no statistical difference in anti-Xa levels in the subgroup of patients weighing 125kg or more and patients weighing less than 125kg, in the 24 hour study period (P equals 0.3). Further analysis of the 8 patients who did not achieve adequate anti-Xa levels in the first 24 hours revealed that 5 had incorrectly titrated infusions. There were 42 patients who achieved anti-Xa levels greater than or equal to 0.3 anti-Xa units per ml, but not less than 0.81 anti-Xa units per ml within the first 24 hours. Further analysis of these patients revealed that 24 had incorrectly titrated infusions, and 4 had incomplete medication documentation. The rate of major bleeding by our definition was 1.3 percent. Literature reports of major bleeding vary from 2 to 4 percent.

**Conclusion:** Our evaluation demonstrated that the percentage of patients with heparin infusions adjusted using the algorithm in our adult weight base heparin protocol that attained adequate heparin levels within the first 24 hours of the heparin infusion is comparable to favorable statistics reported in the literature. We also noted no statistical difference between attainment of adequate anti-Xa levels in patients weighing 125kg or more and those weighing less than 125kg, in the study period. The investigators were concerned that most of the patients with anti-Xa levels that were inadequate during the study period had infusions that were incorrectly titrated. This was also true for patients who achieved anti-Xa levels greater than or equal to 0.3 anti-Xa units per ml, but not less than 0.81 anti-Xa units per ml within the first 24 hours. Our adult weight based heparin algorithm is currently under revision to address titration calculations and medication documentation problems revealed in our evaluation. Studies of real-world applications of weight based heparin protocols report a major bleeding rate of 2-4 percent. Although our rate of 1.3 percent compares favorably to literature findings, length of data collection and definition of a major bleed vary widely. Additionally, we may have excluded some patients who did not achieve adequate heparin levels within 24 hours but had infusions stopped due to bleeding. Our project yielded enough data to take action to improve our algorithm to favorably impact anticoagulation safety in our setting.

**5-010**

**Category:** Cardiology / Anticoagulation

**Title:** Clinical and economic evaluation of rivaroxaban for stroke prophylaxis in patients with atrial fibrillation with implications for the Veterans Affairs budget

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**Purpose:** The purpose of this evaluation is to evaluate cost effectiveness of rivaroxaban in stroke prophylaxis in patients with atrial fibrillation as compared with warfarin and dabigatran from the perspective of the Veterans Affairs FY2011 budget.

**Methods:** Systematic literature review of both the clinical and economic literature were conducted using Pubmed using search terms: (warfarin OR dabigatran OR rivaroxaban) AND atrial fibrillation and (warfarin OR dabigatran OR rivaroxaban) AND atrial fibrillation AND (cost\* OR econ\* OR budget). Limits of the clinical and economic search included English, clinical trial, and human. For the economic search, an additional requirement was one or more oral anticoagulants. The results of the search included 2 studies for the clinical literature and 4 studies for the economic literature. The budget impact analysis took the perspective of the entire Veterans Affairs hospital system for the 2011 fiscal year. Budget costs were confined to medication costs, INR monitoring (where applicable), and cost of serious adverse events. Three scenarios were evaluated in which all patients with NVAf were treated with one of the following: warfarin, dabigatran, or rivaroxaban. Drug costs were taken from federal contract prices, and monitoring/ADE costs. RE-LY were taken from available relevant economic sources; estimated population with atrial fibrillation in VA was 76,894.

**Results:** Treating VA patients with atrial fibrillation with rivaroxaban would cost the VA an additional \$162.9 million per year compared to warfarin, or \$41.3 million per year compared to dabigatran. In analysis, it was determined that rivaroxaban would need to cost no more than \$21.79/patient/month in order to provide equal value to warfarin (11% of its current cost), or \$154.65/patient/month in order to provide equal value to dabigatran (79% of its current cost). For comparison, at VA contract prices, drug cost of warfarin is approximately \$1.50/patient/month. Similarly, INR monitoring would have to cost \$1931/patient/year for equal cost-efficacy of rivaroxaban. Estimates of monitoring cost vary, but our base case assumed monitoring cost of \$186/patient/year (less than 10% of this value). At this time, we found no patient subgroup where rivaroxaban is the preferred therapy; however, patients with compliance issues or difficulty obtaining regular INR tests may benefit from rivaroxaban therapy.

**Conclusion:** Rivaroxaban does not provide equal value to warfarin for stroke prophylaxis in patients with NVAF, as it would cost the VA an additional \$162.9 million per year compared to warfarin. Cost effectiveness would only be achieved with a steep decline in drug cost. Rivaroxaban similarly does not provide equal value to dabigatran in this patient population, costing the VA an additional \$41.3 million per year. With a reasonable decrease in drug cost (21%), rivaroxaban may be considered as an alternative to dabigatran in patients with atrial fibrillation. Benefits of once-daily dosing and antidote for rivaroxaban are unclear in this economic evaluation, as are possible implications for providers other than the Veterans Affairs system.

**5-011**

**Category:** Cardiology / Anticoagulation

**Title:** Evaluating the reasons for dabigatran discontinuation in a community hospital and anticoagulation clinic

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**Purpose:** Dabigatran is an orally active direct thrombin inhibitor approved in 2010 to reduce the risk of systemic embolism and stroke in patients with nonvalvular atrial fibrillation. In the RE-LY trial the relative risk of stroke was 35 percent lower in those patients receiving dabigatran compared to those receiving warfarin. However, discontinuation of therapy occurred more frequently in those receiving dabigatran than in those receiving warfarin. Recently, patients who were previously treated with dabigatran have returned to the pharmacist managed Lutheran Hospital Anticoagulation Clinic in order to either initiate or restart warfarin therapy. In addition, patients admitted to Lutheran Hospital who were previously treated with dabigatran have also switched to warfarin therapy. The goal of this study was to evaluate the reasons for dabigatran discontinuation in patients switched to warfarin therapy in the real world setting.

**Methods:** This study was submitted and approved by the Lutheran Hospital Institutional Review Board prior to initiation. This study was conducted at Lutheran Hospital and the Lutheran Hospital Anticoagulation Clinic in Fort Wayne, Indiana. Information indicating why patients were changed from dabigatran therapy to warfarin therapy was collected via patient interviews and review of patient charts. In addition, data collected included patient age, sex, past medical history, indication for anticoagulation, and renal function. Patients in this study were followed from the time dabigatran was released in November 2010 until April 2012.

**Results:** We identified 21 patients who had been switched from dabigatran to warfarin during the specified time frame. These patients had an average age of 76 years, while 57 percent of the population was male. The average duration of dabigatran treatment was four months. The most common reason for discontinuation of dabigatran therapy was cost, occurring in five patients. The next most common reasons cited for discontinuation of dabigatran were intolerable gastrointestinal effects (n=3), skin reactions (n=3), capsule size (n=2), and age (n=2). Two patients were receiving dabigatran for off-label indications, which lead to discontinuation of therapy. In May of 2012 the Lutheran Medical Group, which admits patients to Lutheran Hospital and refers patients to the Lutheran Hospital Anticoagulation Clinic, determined that they had 66 patients who were receiving dabigatran. Therefore, these 21 patients who discontinued therapy may represent a greater percentage than that seen in clinical trials.

**Conclusion:** The rate of discontinuation of dabigatran in this analysis appears to be greater than that reported in clinical trials. These results show that when dabigatran therapy is being considered, cost, age, renal function, and a patients willingness to handle gastrointestinal side effects should all be considered. This data should be used to assist with patient education, physician prescribing, and identification of reportable adverse effects.

**5-012**

**Category:** Cardiology / Anticoagulation

**Title:** Assessment of the use of a novel method to educate clinical staff pharmacists on 2012 CHEST guidelines

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**Purpose:** The purpose of this study was to ensure that all front line clinical staff pharmacists are aware of recent guideline updates and are able to disseminate and apply the most current recommendations in their clinical practice. Continuing education of clinical staff pharmacists on new guideline updates has historically been difficult due to time constraints, shift changes, and staffing requirements. The 9th edition of the CHEST guidelines on antithrombotic therapy and prevention of thrombosis were published early 2012. Education on these guidelines is important in all inpatient settings; however, understanding of these guidelines is essential in our facility due to our status as an accredited Acute Myocardial Infarction Center. In order to educate our pharmacists on the new guidelines, a novel educational model was employed.

**Methods:** The CHEST guidelines were evaluated by chapter. Chapters were prioritized based on the information contained in the chapter and its relevance to the daily work practices of our pharmacists. Of the 26 chapters which make up the CHEST guidelines, 18 chapters were chosen to be reviewed and summarized for the clinical staff pharmacists. The 18 chapters were assigned to 13 different clinical specialists and cardiology-focused clinical staff pharmacists with instructions to develop and present a 30-minute active learning module based on the information provided in the updated CHEST guidelines. The 18 chapters were presented in one-hour increments over 9 separate days (2 chapters per day). The presenters were challenged with developing and utilizing a novel teaching method to engage learners in the presentation of the material. These novel methods included interactive games, such as Jeopardy, a matching game, and case-based discussions. These novel methods were intended to meet ACPEs Standard 7 to assure that all continuing education includes active participation and involvement of the pharmacist. The presentations were also submitted to the North Carolina Association of Pharmacists, and live continuing education credit was awarded in one-hour increments per session. If all 9 sessions were attended, the participants received the maximum of nine hours of live continuing education credit. After all education sessions were complete, a 5-item survey was distributed to all pharmacists who attended at least one session. The survey was intended to assess pharmacists impressions of how well the sessions accomplished the goal of providing education on the new guidelines and whether the novel methods of teaching the material were helpful in their understanding.

**Results:** A total of 55 of the 75 pharmacists (73.3 percent) in our department attended at least one of the CE sessions. The average number of sessions attended by pharmacists was 3.2

sessions. Of the 55 pharmacists that received the survey, 41 pharmacists responded to the survey providing a 74.5 percent response rate. Most responders (58.5 percent) have been in practice for fewer than 10 years and 46.3 percent of responders have been employed at our facility for 0-3 years. Twenty-seven percent of the responders have been employed at our hospital for greater than 10 years, making up the second highest group of responders. The majority of responders (90.2 percent) stated that they monitor anticoagulation during the course of everyday practice. Most responders (68.3 percent) stated that they agreed or strongly agreed that they felt comfortable speaking to other providers regarding the 2012 CHEST guidelines, as compared to 65.8 percent of respondents who agreed or strongly agreed that they felt comfortable speaking to other providers regarding the four-year-old 2008 CHEST guidelines statement. When asked if they believed that the material was presented in a way that helped them understand and learn the material, 73.2 percent of respondents agreed or strongly agreed with that statement. Further, when asked if they would have attended these sessions even if continuing education credit was not given, 95.1 percent of respondents agreed with this statement. Finally, 85.3 percent of respondents agreed or strongly agreed that the presentation series will improve their job performance.

**Conclusion:** The 2012 CHEST guidelines update series was presented using novel teaching methods which enabled our pharmacists to become more familiar with the material as compared to the previous guidelines, which have been in place for four years. The CHEST guidelines update series has enabled our attendees to increase their job effectiveness through increased understanding of the guidelines. Our next steps are to review our current training practices and determine if we can apply similar methods of teaching to further improve our pharmacists' knowledge of current medical literature.

**5-013**

**Category:** Cardiology / Anticoagulation

**Title:** Impact of receiving target dose angiotensin converting enzyme (ACE) inhibitor/angiotensin II receptor blocker (ARB) or beta-blocker therapy on follow-up care in patients with heart failure

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**Purpose:** Current heart failure (HF) guidelines recommend titration of angiotensin converting enzyme (ACE) inhibitor/angiotensin II receptor blocker (ARB) therapy and beta-blocker therapy to target doses in order to maximize benefit, as seen in clinical trials. However, many patients do not achieve these target doses due to various reasons. Patients with HF also require frequent follow-up to achieve and maintain optimal outcomes. We sought to determine the impact of achieving target dose ACE inhibitor/ARB or beta-blocker therapy on follow-up care in patients with HF.

**Methods:** The institutional review board approved this retrospective, case-control study. Patients were identified using medical claims from Blue Cross Blue Shield of Nebraska (BCBSNE) database from 1/1/2009 through 12/31/2010. Patients were included in the analysis if they were greater than 18 years old, had active enrollment in BCBSNE during entire collection period, initial HF diagnosis between 4/1/2009 and 6/30/2010, and at least 3 medication claims for an ACE inhibitor, ARB, or beta-blocker. Patients with HF were identified using ICD-9 codes, excluding those with diastolic HF. Patients had to have at least six months of follow-up data post the index date of HF diagnosis. Generic product identifier (GPI) codes were used to identify medication, and total daily dose. Patients were then classified as at target dose or not at target dose. The target dose group had to have greater than 2 consecutive medical claims at or above the guideline recommended target dose. The primary outcome was defined as a subsequent heart failure diagnosis code claim (billing as primary, secondary or tertiary claims). 103 outcomes were isolated and analyzed based on dichotomous variables (did the patient achieve target dose or not) using the Fishers Exact Test.

**Results:** There were 320 patients that met all inclusion and follow-up criteria for our study. Baseline characteristics between those at target dose and those not at target dose were similar. There were 103 patients (32%) who achieved target dose ACE inhibitor/ARB, compared to 217 (68%) who did not. Patients achieving target dose ACE inhibitor/ARB did not have a difference in follow-up care compared to those who did not achieve target dose (34% vs. 31%;  $p=0.7011$ ). There were 79 patients (25%) who achieved target dose beta-blocker compared to 241 (75%)

who did not. Patients achieving target dose beta-blocker have a significantly higher rate of follow-up compared to those who did not achieve target dose (46% vs. 28%;  $p=0.0053$ ).

**Conclusion:** While patients achieving target dose ACE inhibitor/ARB do not have a difference in medical claims for follow-up, being on target dose beta-blocker seems to be a marker for patients obtaining more consistent care. Unfortunately, most patients are not achieving target doses of these life-saving medications.

**5-014**

**Category:** Cardiology / Anticoagulation

**Title:** Retrospective drug utilization evaluation to validate the use of a weight-based heparin protocol for initiation of a heparin infusion in the treatment of venous thromboembolism and cardiac indications.

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**Purpose:** A retrospective heparin evaluation in 2010 compared patients from a 5 month period of time in 2009 (22 patients) with the same 5 month period in 2010 (15 patients). It revealed that it was taking a greater amount of time in 2010 to achieve the first therapeutic activated partial thromboplastin time (aPTT) and a larger dose of heparin to achieve this therapeutic aPTT. After ruling out possible causes such as the 2009 decrease in heparin potency, source of premixed heparin bags, and a change in lab reagents, a second retrospective 24 month evaluation was conducted. The purpose of this second evaluation was to determine if the weight-based heparin infusion protocol currently in place at our institution was valid or if it needed to be modified. The efficacy of heparin in the initial treatment of VTE critically depends on the dosage and studies have shown that patients assigned to lower starting doses of heparin had higher recurrence rates of thromboembolism than those treated with higher doses.

**Methods:** The institutional review board approved the retrospective drug utilization evaluation. The weight-based heparin protocol was developed based on Antithrombotic and Thrombolytic Therapy: American College of Chest Physicians (ACCP) Evidence-Based Clinical Practice Guidelines (8th Edition). The performance of this protocol was evaluated through a retrospective evaluation over a 2 year period. The following data elements were abstracted from the electronic medical record: indication, initial bolus dose, infusion rate, 6 and 12 hour aPTTs, age, and patient weight. The primary outcome measure was the proportion of patients achieving a therapeutic aPTT or higher at 6 hours after initiation and the mean infusion rate necessary to attain this therapeutic aPTT. Secondary outcomes measured included the proportion of patients achieving a therapeutic aPTT at 6 and 12 hours receiving infusion rates of 12, 14, or 18 units/kg/hour with and without bolus doses.

**Results:** One hundred fifty-six patient electronic medical records from 2010 and 2011 were reviewed. Patient age ranged from 22 to 92 years old (average age was 67) with 55% of the patients having an indication of VTE and 45% having a cardiac indication. The percentage of patients achieving a therapeutic aPTT of 60 seconds or higher at 6 hours after initiation and received a bolus dose at the start of the infusion was 80% versus 39% in those patients who did not receive a bolus dose. It was noted that a bolus dose was ordered only 47% of the time. An initial bolus dose with an infusion rate of 18 units/kg/hour was the rate that provided 6 hour aPTTs of 60 seconds or above 94% of the time, however only 12.5% of those patients were in

the therapeutic range of 60 to 100. In 2010, 61% of patients who did not receive a bolus dose at the initiation of heparin were found to have sub-therapeutic aPTTs at 6 and 12 hours regardless if the infusion rate was 12, 14, or 18 units/kg/hour. In 2011, the average time to achieve the first therapeutic aPTT was 12 hours and the average infusion dose of heparin to achieve this therapeutic aPTT was 15 units/kg/hour.

**Conclusion:** Results of the drug utilization evaluation supported the continued use of the weight-based heparin infusion order form currently in place at our institution. The increase noted in the time to attainment of therapeutic anticoagulation (the first therapeutic aPTT) and the increase in the infusion rate of heparin necessary to achieve this therapeutic aPTT, was most likely due to the prescriber not ordering the ACCP recommended bolus doses and infusion rates. A patient who receives an appropriate heparin bolus at the start of the infusion along with an adequate infusion rate is much more likely to achieve a therapeutic aPTT in 6 to 12 hours. The anticoagulation team decided it was necessary to educate physicians, nurses, and pharmacists regarding appropriate heparin infusion dosing and educate nursing and lab personnel about appropriate collection of aPTTs. The results were presented at a Pharmacy and Therapeutics Committee meeting and an educational newsletter describing the drug use evaluation results were sent to the hospital physicians, nurses, and pharmacists.

**5-015**

**Category:** Cardiology / Anticoagulation

**Title:** Evaluation of compliance and validation of an institution specific weight based heparin nomogram

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**Purpose:** The nomogram currently utilized by this institution differs from the Raschke nomogram in that the infusion is not held or adjusted if a patient has a supratherapeutic activated partial thromboplastin time (aPTT) 6 hours post bolus. The primary purpose is to validate this practice and determine if it is associated with an increased risk of bleeding. Compliance is evaluated before and after implementation of a redesigned nomogram.

**Methods:** A chart review was performed on patients who received intravenous heparin for at least 24 consecutive hours for treatment of deep vein thrombosis (DVT) or pulmonary embolism (PE). Data collection included: age, gender, weight, heparin indication, aPTT values and dose adjustments for the first 48 hours, initial bolus and infusion rate, time until therapeutic aPTT achieved, and bleeding events within 48 hours of initiation. All interventions and the time they occurred were documented before and after initiation of the redesigned nomogram.

**Results:** Data was collected from 50 patients using the initial nomogram and from 50 patients using the redesigned nomogram. Fifty percent of patients were therapeutic within 24 hours before versus 82 percent after implementation of the new nomogram ( $p=0.001$ ). Compliance was found to be 55 percent with the previous nomogram and 74 percent with the redesigned nomogram ( $p<0.001$ ). There was no statistical difference seen between the two groups with respect to bleeding complications.

**Conclusion:** The current practice of not holding or adjusting a patients therapy if they have a supratherapeutic aPTT 6 hours post bolus was not correlated to increased bleeding events. Critical evaluation and redesign of the nomogram resulted in several changes which made it easier to interpret, led to a 19% increase in compliance, and resulted in more patients achieving a therapeutic aPTT within 24 hours of heparin initiation.

**5-016**

**Category:** Cardiology / Anticoagulation

**Title:** Factors Affecting Heart Failure Readmission Rates in Jesse Brown VA Medical Center Patients

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**Purpose:** Heart failure (HF) is a growing health problem in the United States, accounting for 1.1 million hospitalizations annually. HF related hospitalizations place a major financial burden on patients, caregivers, and the national healthcare system. Furthermore, over 50% of HF patients are re-hospitalized before their first outpatient follow-up. The Veterans Affairs (VA) healthcare system has a growing number of Veterans with HF, and HF is the leading discharge diagnosis in patients treated at the VA hospitals. The purpose of this study was to determine major factors contributing to hospital readmissions for HF at Jesse Brown VA Medical Center (JBVAMC) in order to identify areas for improvement in regards to quality of care and HF readmission rates.

**Methods:** This study was a retrospective, electronic chart review of JBVAMC patients hospitalized for a HF exacerbation any time between October 1, 2010 and March 1, 2011. A report was generated to identify potential study patients using ICD-9 HF codes. The report specifically included patients discharged from JBVAMC with a principal discharge diagnosis of HF. A list was generated to review a maximum of 250 patients. Patients aged 18 years and older with one of the ICD-9 HF codes as the principal discharge diagnosis between October 1, 2010 and March 1, 2011 were included in the study. Patients were excluded if transferred to/from an outside hospital, discharged without an ICD-9 principal diagnosis code for HF, electively admitted, not treated for HF during hospitalization, left the hospital against medical advice (AMA), had chart documentation with comfort measures only, discharged/transferred to hospice, had active HF medications listed under non-VA medications in the electronic profile, or did not receive follow-up at JBVAMC. Baseline, hospitalization, post-discharge, and re-admission information was collected, including demographics, co-morbid conditions, vital signs, select laboratory values, patient medications, medication compliance, length of in-hospital oral diuretic therapy, in-hospital HF assessment, and frequency/type of follow-up. The primary endpoint was the difference in patient characteristics between two groups of patients, those readmitted for HF within thirty days of the index hospitalization and those readmitted after thirty days or not at all.

**Results:** Six patients were readmitted within thirty days of the index HF hospitalization. Patients readmitted for HF within thirty days received oral diuretic therapy for 50% less time after discontinuation of the intravenous (IV) diuretic therapy prior to discharge than patients who were readmitted for HF after thirty days or not at all. Additionally, 20% less of these patients with LVEF less than 40% were discharged on an angiotensin converting enzyme inhibitor/angiotensin

receptor blocker (ACE-I/ARB) and 35% less were discharged on a -blocker. Medication non-compliance and follow-up non-compliance was 47% and 44% greater among the patients in this group. Furthermore, patients readmitted within thirty days had 15% less follow-up scheduled at the time of discharge, 8% lower CHF clinic enrollment, and 5% lower CHF-PharmD clinic enrollment than the patients who were readmitted after thirty days or not at all.

**Conclusion:** JBVAMC had a low percent of patients readmitted for HF within thirty days. Overall trends showed that earlier and more frequent readmissions were more common in patients who received oral diuretic therapy for less than 24 hours prior to discharge, were not discharged on an ACE-I/ARB and a -blocker, were non-compliant with medications and follow-up appointments, did not have follow-up scheduled at discharge, and were not enrolled in CHF and/or CHF-PharmD clinic. In addition, the majority of systolic HF patients were not at target doses of an ACE-I/ARB and a -blocker when readmitted. These findings suggest that there is room for improvement in reducing HF readmissions at JBVAMC.

**5-017**

**Category:** Cardiology / Anticoagulation

**Title:** Impact of pharmacist discharge education and interventions on publically reported heart failure measures

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**Purpose:** The Centers for Medicare and Medicaid Services (CMS) publically report 30-day mortality measures and readmission rates for heart failure (HF) patients. CMS has defined HF core measures to guide the quality improvement process including: 1) discharge instructions accuracy, 2) left ventricular function assessment, and 3) angiotensin converting enzyme (ACE) inhibitor or angiotensin receptor blocker (ARB) for ejection fraction (EF) < 40% (or documentation if contraindicated). A pilot program of decentralized pharmacists providing discharge medication reconciliation and discharge instructions was initiated on a cardiac telemetry unit in a large urban community hospital. The purpose of this study is to assess if pharmacist-provided discharge education and interventions improve publically reported hospital measures and core measure compliance for HF patients.

**Methods:** The primary objective of this study is to compare the difference in heart failure and all-cause readmission rates before and after pilot initiation in February 2012. Secondary objectives include changes in HF core measure compliance rates for discharge instructions and prescription of ACE/ARB for patients with EF < 40%. Pharmacist intervention type and acceptance rates are also assessed using descriptive statistics. This is a combination cohort study with prospective and retrospective design. Medical records, documented pharmacist-interventions, and publically-reported compliance with CMS core measures for HF patients on a cardiac telemetry unit were retrospectively reported. Patients were included in the study if they were discharged to home from this cardiac telemetry unit and excluded if discharged to an assisted-living facility, skilled nursing facility, or hospice.

**Results:** After implementation of the discharge pilot program, there was a decrease in publically reported heart failure and all-cause readmission rates. CMS HF core measure compliance improved for discharge instructions and continued to be 100% for ACE/ARB prescription for EF < 40%. There were 100 reported pharmacist interventions with an overall 90% acceptance rate including the following types of interventions: core measure medication/documentation, discharge instruction paperwork, medication reconciliation, and therapy complete/altered for safety

**Conclusion:** Pharmacist-provided discharge education and interventions reduced publically reported readmission rates for patients with heart failure and increased compliance for the discharge instruction core measures.

**5-018**

**Category:** Cardiology / Anticoagulation

**Title:** Most frequent medical conditions concomitant with atrial fibrillation in men and women and use of anticoagulation in the ORBIT-AF registry

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**Purpose:** Atrial fibrillation (AF) may be associated with a variety of risk factors for stroke as well as bleeding. Some of these risk factors are modifiable comorbidities (e.g., hypertension, hyperlipidemia, diabetes) while others are non-modifiable characteristics (e.g., age, gender, history of malignancy). We analyzed data collected in the Outcomes Registry for Better Informed Treatment of Atrial Fibrillation (ORBIT-AF) to identify patterns of medical comorbidities and anticoagulation drug utilization in AF patients, and determine whether differences exist between gender.

**Methods:** Data were analyzed from a large, community-based registry of patients with AF in the U.S. Observations were based on baseline data in more than 10,000 patients across 173 sites across various ambulatory clinic practice settings, including primary care, general cardiology, and electrophysiology. Differences between men and women in comorbidities were examined using Chi-square tests for categorical variables. Anticoagulation treatment included any use of warfarin, with or without antiplatelet therapy.

**Results:** The analysis included 10,120 AF patients, of whom 57.6% were male. Female AF patients were significantly older than male patients (75.2 years vs. 71.3 years,  $p < 0.001$ ). Comorbidity burden was high for this population, with a mean of 5.8 conditions (sd=2.92). Cardiovascular comorbidities were prevalent in this AF population; the top four comorbidities were cardiovascular related: hypertension, hyperlipidemia, heart failure, and coronary heart disease. Approximately one-third of this population had concomitant heart failure or coronary artery disease. Hyperlipidemia, heart failure, coronary heart disease, diabetes, and obstructive sleep apnea were more prevalent in men; hypertension, thyroid disease, anemia, and osteoporosis were more prevalent in women. Use of anticoagulation therapy, stratified by comorbidity, and adjusted for age was not significantly different between men and women for most of the top comorbidities except for COPD. Women with COPD were less likely ( $p=0.040$ ) to receive anticoagulation therapy compared with men.

**Conclusion:** Comorbid conditions are frequently present in patients with AF and vary in prevalence by patient gender. Cardiovascular comorbidities were predominant among the 10

most frequent comorbidities. Overall, anticoagulation did not vary significantly between men and women with the exception for female COPD patients who were less likely to receive anticoagulation therapy than their male counterpart.

**5-019**

**Category:** Cardiology / Anticoagulation

**Title:** Prevalence, associated comorbidities, and burden of a prior myocardial infarction among patients with venous thromboembolism

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**Purpose:** Patients with venous thromboembolism (VTE), comprised of deep vein thrombosis (DVT) and pulmonary embolism (PE), are at an increased risk for a myocardial infarction (MI). The aim of the current study was to assess the prevalence, associated comorbidities, and health outcome implications of a prior MI among patients with VTE.

**Methods:** Data from the 2010 US National Health and Wellness Survey (NHWS) were used. The NHWS is an Internet-based patient survey that employs a random stratified sampling framework to ensure demographic representativeness of the total adult US population. The prevalence of a prior MI was estimated among patients with either DVT or PE. Patients with a prior MI were compared with patients without a prior MI on self-reported comorbidities using chi-square tests. Differences between groups were also examined using regression modeling, controlling for age, gender, and the Charlson Comorbidity Index. All patients provided informed consent, and the study was approved by the Essex Institutional Review Board, Lebanon, New Jersey.

**Results:** Of the 618 patients who reported a diagnosis of DVT and 295 patients who reported a diagnosis of PE, 9.71% and 13.22%, respectively, reported a prior MI (n=60 and 39, respectively). The presence of a prior MI was associated with a number of other chronic conditions in patients with either DVT or PE, including hypertension (DVT: 77.3%, PE: 74.4%), hypercholesterolemia (DVT: 75.6%, PE: 76.4%), and pain (DVT: 64.0%, PE: 68.1%). Several comorbidities were more prevalent among those with an MI than those without, including hypertension, hypercholesterolemia, diabetes, chronic obstructive pulmonary disease, and congestive heart failure. Adjusting for confounding variables, patients with DVT and a prior MI reported significantly lower physical component summary scores than patients with DVT and no prior MI (34.9 vs. 39.0,  $P<0.05$ ).

**Conclusion:** These results suggest that MIs are relatively common among patients with both DVT and PE and are associated with a number of comorbidities. Healthcare providers should be

aware of the prevalence of these comorbidities and their effect on complicating disease management.

**5-020**

**Category:** Cardiology / Anticoagulation

**Title:** Evaluation of proper prescribing of cardiac medications at hospital discharge for patients with acute coronary syndromes (ACS) in two Lebanese hospitals

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**Purpose:** Coronary artery disease (CAD) is the major leading cause of death worldwide. The national practice guidelines from the American College of Cardiology (ACC) and American Heart Association (AHA) promote the use of several medical therapies for secondary prevention for patients with CAD. The purpose of this study was to evaluate whether ACS patients, admitted into two tertiary referral medical centers in Beirut, Lebanon, are discharged on optimal medical therapy based on the AHA/ACC guideline.

**Methods:** We reviewed the medical records of all patients with ACS who were admitted to the coronary care units (CCU) of two hospitals in Beirut, Lebanon between May and June 2012. Information gathered included demographic variables, comorbid conditions, physical findings, laboratory and radiographic studies, vital signs, and patient medical management. Discharge prescriptions were reviewed and rating for the appropriateness of discharge cardiac medications was based on the AHA/ACC guidelines. We assessed whether patients were discharged on antiplatelet therapy, -blockers, angiotensin converting enzymes inhibitors (ACEIs) or angiotensin receptor blockers (ARBs), statins, and nitrates, unless contraindicated or not tolerated. In addition, we assessed whether patients and their families were counseled about their disease(s) and discharge medications.

**Results:** Eighty patients with a mean age of 63.11 years, 56 (70%) of which were males, were admitted with ACS and were included in the study. Twenty four (30%) patients had ST elevation MI (STEMI), 27 (33.75%) had non-ST elevation MI (NSTEMI) and 29 (36.25%) had unstable angina (USA). Twenty six (32.5%) patients were treated medically and 54 (67.5%) patients underwent percutaneous coronary intervention (PCI). Ninety five percent of the patients were discharged on aspirin, 80 % on a thienopyridine, 83.75% on -blockers, 86.25% on statins, 82.5% on ACEIs or ARBs, and 26.25% on nitroglycerin. Two patients did not receive antiplatelet therapy due to active bleeding. Three patients did not receive -blocker therapy; two had bradycardia and one had decompensated heart failure. Overall, 55% of the patients received the optimal cardiovascular drug therapy (the combination of aspirin, a -blocker, an ACEIs or an ARB, and a statin), 45% were counseled on their disease state(s) and drug therapy, and 55 % were counseled on smoking cessation and life style changes. Ramipril, rosuvastatin and bisoprolol were the most commonly prescribed ACEI, statin, and -blocker, respectively.

**Conclusion:** In patients admitted with ACS, discharge cardiac medications are prescribed at suboptimal rates. Education of healthcare providers and implementation of ACS discharge protocols may help improve compliance with ACC/AHA guidelines. In addition, clinicians should be encouraged to provide adequate patient counseling.

5-021

**Category:** Cardiology / Anticoagulation

**Title:** Occurrence of venous thromboembolism despite prophylaxis in an obese patient population at an academic medical center

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**Purpose:** Care plan processes to prevent venous thromboembolism (VTE) are abundant in the literature and are accompanied by a growing list of individual patient risk factors. Obesity has been identified as an independent characteristic of risk for the development of VTE. Growing concern regarding the increasing incidence of obesity has been noted with early speculations as to its impact on the healthcare system, including medication therapy. Despite these concerns, firm recommendations are lacking to direct therapy for VTE prevention in the obese population. With financial reimbursement tied to prevention of hospital acquired conditions, it was prudent to evaluate the prescribing of therapy for VTE prevention with consideration of specific patient characteristics. The primary outcome is to determine the incidence of VTE in obese patients receiving pharmacologic prophylaxis. The secondary outcome is to determine the individual incidence of VTE in obese and morbidly obese patients receiving pharmacologic prophylaxis on general medicine floors versus intensive care units.

**Methods:** A retrospective chart review was conducted assessing all non-pregnant patients 18 years of age or greater who received pharmacologic VTE prophylaxis between January 1, 2007 and July 30, 2011. Patients receiving enoxaparin and heparin, administered in varying doses, were included. Additional collected data included: location of care, VTE occurrence and body mass index. Exclusion criteria included those admitted to the hospital with a new VTE diagnosis or concurrent use of therapeutic anticoagulation. This project was approved by the institutional review board. Statistical analyses performed included: chi-squared, t-tests, and logistic regression.

**Results:** Initial analysis did not reveal weight to be statistically significant predictor of DVT occurrence alone, however, became significant when coupled with location of care. Use of a logistic regression model yielded an odds ratio that VTE occurrence in the obese population in the ICU setting was 2.11 times more likely when compared to obese patients on general medicine floors. (95 percent CI; 1.11 percent to 4.02 percent, p equals 0.0228) Despite testing for age, dosing and type of prophylaxis, these factors did not result in similar increases in incidence as found by location alone.

**Conclusion:** As critically ill patients inherently have increased independent risk factors attributed to VTE development, including sepsis, trauma, surgery, and prolonged immobility, further analysis will need to be conducted to evaluate the results of this study. Alteration of dosing strategies may be warranted in this patient population, but requires further inquiry.

5-022

**Category:** Cardiology / Anticoagulation

**Title:** Warfarin discharge counseling pilot evaluation

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**Purpose:** Warfarin is a high risk drug for adverse events and is associated with a ten-fold chance for bleeding during the first month of therapy. The National Quality Forum in response to National Patient Safety Goals (NPSG) regarding anticoagulation therapy has mandated an implementation of a formalized anticoagulation management program to reduce potential for patient harm with the use of anticoagulation therapy. The guidelines also recommend that patient/family education includes importance of follow-up in order to monitor patients. To evaluate potential means to meet these goals the Cleveland Clinic Department of Pharmacy has implemented a warfarin discharge counseling pilot to determine quality assurance of patient education at discharge and continuity of care post-discharge.

**Methods:** A descriptive concurrent study was conducted on a cardiology step down unit. The primary outcome was to determine, via a phone follow-up survey 7-14 days post discharge, the percentage of patients attending a post discharge follow-up appointment to monitor warfarin therapy. The secondary outcome was to determine patients level of warfarin understanding after a warfarin session with a pharmacist via a quality assurance survey developed for this study. Patients 18 years or older discharged to home on warfarin therapy were included. Exclusion criteria included patients discharged to a skilled nursing facility and those unable to speak and understand English. Also patients unable to be reached via a telephone were excluded from the primary outcome analysis. The timeframe for the pilot was November 1-December 9, 2011. Primary and secondary objectives were analyzed using descriptive statistics. Chi-square was used when appropriate. An alpha level <0.05 was deemed statistically significant.

**Results:** There were a total of 79 warfarin consults over the 39 pilot days with 64 completed consults by a pharmacist. Out of the 64 counseled patients, 45 participated in the inpatient quality assurance survey and 41 consented for post-discharge follow-up phone call. For patients who gave permission for follow-up phone call, 70.7% attended post-discharge follow-up appointment, 9.8% had an appointment scheduled for the future, 7.3% were aware of follow-up appointment but did not attend and 12.2% were unable to follow-up for other reasons. The inpatient quality assurance survey showed 28.9% of patients agreed and 64.4% of patients strongly agreed that they had an overall understanding of their warfarin therapy after the counseling session with a pharmacist.

**Conclusion:** To meet the NPSG, we evaluated a warfarin discharge pilot and found that pharmacists counseling patients on warfarin therapy ensures that patients are educated on their medications and receive follow-up appointment instructions.

5-023

**Category:** Cardiology / Anticoagulation

**Title:** Transforming anticoagulant patient education

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**Purpose:** The provision of medication teaching (MT) to patients by pharmacists remains an important activity within the expanding spectrum of clinical pharmacy services. There is a strong body of evidence that demonstrates clinical patient outcomes correlate directly with MT. One example highlighting the importance of MT is illustrated by the 2008 Joint Commission National Patient Safety Goal 3E (now known as 03.05.01) focusing on reducing harm associated with anticoagulation therapy. A substantial part of this initiative focuses on providing effective MT and ensuring continuity of care. Additionally, many modern health care systems are making substantial investments in new information technology resulting in robust integrated health systems (IHS). Developing innovative ways to leverage technology so that patients are more engaged in their care should ideally result in a more effective MT process and improved patient experience. The purpose of this study was to quantify the effect of an IHS in a mid-sized community hospital setting on the provision of MT by nurses and pharmacists. The primary outcomes of interest were 1) rate of MT provided to patients at discharge, 2) utilization of electronic documentation, 3) impact of procedural modifications using a safety design approach. A secondary purpose to our study was to identify potential opportunities for incorporating new educational tools such as mobile devices in the MT process.

**Methods:** This was a prospective, observational study and data was collected over a two year period starting in 2010. Clinical pharmacists focused on patients needing anticoagulation MT at the time of discharge. There was a mid-point data evaluation, an interventional opportunity, and post data collection. The sample size included 300 patients.

**Results:** The baseline rate of MT documentation was 15% (n=150). An intervention consisting of a series of procedural changes developed by multi-disciplinary action team was implemented. The post intervention rate of MT documentation was 94% (n=150).

**Conclusion:** A large number of patients were being sent home on anticoagulant medications without MT, placing them at higher risk for complications and poor outcomes. Prior to the intervention, the MT electronic application within the IHS was not fully being used by nurses or pharmacists. It was determined that it was necessary to develop a new MT implementation strategy including: 1) defining the allocation of tasks, 2) making electronic documentation more concise, and 3) employing safety designed intervention reminders. Following the integration of

procedural changes in the IHS, a substantial increase in the rate of MT documentation was observed. Our experience will likely be of interest to all clinical pharmacists who work at sites with a IHS and have responsibilities for providing MT. A future area of opportunity that was revealed to us through the course of this study involves the design and display of educational material compatible with mobile devices in an attempt to improve MT in a manner that is more patient-centric and impactful.

5-024

**Category:** Cardiology / Anticoagulation

**Title:** Recombinant factor VII activated and prothrombin complex concentrate use at a tertiary academic medical center

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**Purpose:** Clotting factors have been shown effective in acute, life-threatening hemorrhage although the indications, dose, and concomitant therapy have yet to be determined. The aim of this analysis was to describe the clinical use of recombinant factor VII activated (rFVIIa) and prothrombin complex concentrate (PCC) in a tertiary academic medical center.

**Methods:** We conducted a single center, prospective, observational study to describe the utilization of rFVIIa and PCC from November 2011 through March 2012. This IRB-approved analysis evaluated the appropriateness of therapy based on institution-specific guidelines in all adult patients receiving rFVIIa and PCC. These guidelines include both FDA approved and unapproved indications. Data collected included baseline demographics, indication, dose, concomitant therapy (blood products, vitamin K, and aminocaproic acid), thromboembolic events, immunological reactions, and need for repeat dosing.

**Results:** Six patients received rFVIIa and 32 patients received PCC during the analysis period. rFVIIa and PCC were utilized appropriately in 100% and 91% of cases according to the institution-specific guidelines, respectively. Sixty-seven percent and 100% of rFVIIa and PCC cases were for non-FDA approved indications, respectively. Indications for rFVIIa included surgical bleeding (50%), factor deficiency (33%), and intracranial hemorrhage (17%). Indications for PCC included intracranial hemorrhage (63%), surgical bleeding (23%), trauma (7%), and other (7%). The average dose for rFVIIa and PCC was 43 mcg/kg and 27 units/kg, respectively. Patients receiving rFVIIa had higher concomitant therapy requirements than those receiving PCC. The mortality rate associated with rFVIIa and PCC was 33% and 26%, respectively. No thromboembolic events or immunological reactions were documented in either patient group. Repeat dosing was more common in the rFVIIa group compared to the PCC group (33.3% vs. 3.2%).

**Conclusion:** rFVIIa and PCC were utilized appropriately in a high percentage of patients according to our institution-specific guidelines. The majority of these clotting factors were used for non-FDA approved indications.

5-025

**Category:** Cardiology / Anticoagulation

**Title:** Development of an oral anticoagulant coagulopathy/bleeding management protocol based on limited evidenced based medicine

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**Purpose:** New oral anticoagulants, rivaroxaban and dabigatran, have recently been approved by the FDA for use in DVT prophylaxis and in atrial fibrillation. Currently, there are no reversal agents for these products, nor studies evaluating the best therapeutic management of patients admitted to the hospital with life threatening bleeds. The product information for these products states that prothrombin complex concentrate (PCC) or factor VII may be considered. However, no clinical studies have been published supporting this recommendation. Due to the rapidly increasing use of these agents in the community, and the incidence of reported major bleeds, health system pharmacy leadership suggested a protocol to assist in the management of these patients

**Methods:** Discussion at the System Pharmacy and Therapeutics Committee resulted in a recommendation to create an oral anticoagulant task force. Membership included select members of the medical staff, administration, laboratory, and pharmacy. The goal of the task force was to review the literature and make recommendations to guide the development of a protocol. The applicable sections of the Chest Guidelines (February 2012) were the primary reference used. The only clinical study using PCC in 20 healthy adults was also evaluated.

**Results:** The task force recommended that the protocol address all oral anticoagulants including warfarin, rivaroxaban, and dabigatran. The resulting protocol includes therapeutic recommendations for both serious and life threatening bleeding, laboratory tests recommended for each specific oral anticoagulant, and the use of dialysis for life threatening bleeding due to dabigatran. PCC was added to the system formulary for use with rivaroxaban and warfarin but not dabigatran due to the lack of supporting literature. The use of Factor VII was only recommended as second line low dose therapy for life threatening intracranial hemorrhage following inadequate response to PCC and other measures. Policy and procedures were developed for the ordering, preparation, and administration of PCC. A table to simplify and round doses was developed to assist the pharmacy staff in preparation of the PCC. Education to the medical, nursing and pharmacy staff on using the protocol and review of procedures was provided.

**Conclusion:** Development of an oral anticoagulant coagulopathy/bleeding management protocol based on limited evidenced based medicine was developed and implemented to provide the medical staff with guidelines for the treatment of patients admitted with life threatening coagulopathies. As new literature becomes available, or new anticoagulants (apixaban?) are approved by the FDA, the protocol will be evaluated for revision

5-026

**Category:** Cardiology / Anticoagulation

**Title:** Extended anti-Xa monitoring of low-molecular-weight heparin in end-stage renal disease: a case report

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**Purpose:** This case report illustrates the possibility of safe and effective low-molecular-weight heparin (LMWH) use in hemodialysis patients with concomitant anti-Xa level monitoring. SS is a 52 year old female with previously established stage 5 chronic kidney disease that progressed to hemodialysis in June 2011. SS developed a new onset right upper extremity deep vein thrombosis after permacath placement. Warfarin initiation was followed by referral for 6 months of anticoagulant management by our established outpatient pharmacist-managed clinic. During month 2, despite subtherapeutic INR values, the patient experienced repeated severe vaginal bleeding from uterine fibroids of 3 week duration. In the interim, chest pain during routine dialysis session prompted hospitalization associated with severe anemia (Hgb 6) and subsequent 4 unit blood transfusion. Continued presence of internal jugular vein thrombus was confirmed on ultrasound. During month 3, additional menorrhagia led to hospitalization necessitating repeat blood transfusion. Over the full three month course consisting of 12 clinic visits, the INR levels fluctuated from 1.2 - 3.4 despite established patient compliance, secondary to possible drug interactions as well undetermined factors. Routine dialysis three times weekly remained uninterrupted during this timeframe. Planned fistula placement and necessary warfarin interruption prompted discussion with referring provider. Review of INR trends and bleeding complications caused the provider to alter therapy to short-term LMWH use for the 3 remaining months of necessary anticoagulation. Secondary to dialysis use, anti-Xa monitoring was recommended and performed by our service. SS initiated enoxaparin therapy during month 3. At that time, SS weighed 86kg and had a Scr of 3.2. SS was started on an enoxaparin dose of 40mg subcutaneously every 12 hours, about 53% lower than the standard 1mg/kg every 12 hours treatment dose. SS's anti-Xa level was checked in clinic 2 days after initiation, after completing three doses of enoxaparin. SS's anti-Xa level at that time was therapeutic at 0.55 units/mL. SS was brought back in to clinic every 1-2 weeks for the first two months of enoxaparin therapy, a total of 7 clinic visits where anti-Xa levels were drawn and assessed. From these seven visits, the anti-Xa level range was 0.33-0.83 units/mL. Of these, six anti-Xa levels were therapeutic between 0.5-1.0 units/mL. The enoxaparin dose of 40mg every 12 hours was not adjusted during this timeframe. After the first two months of enoxaparin therapy, SS was monitored only monthly for 2 visits. During that time, anti-Xa levels did start to trend downward to subtherapeutic levels. However the dose of enoxaparin was not adjusted at that time, as SS neared and reached the end of the duration of anticoagulation therapy. SS was instructed to discontinue enoxaparin after 3 months of enoxaparin therapy. During the entire course of

enoxaparin therapy, SS did not experience any bleeding episodes or any thromboembolic events. SS was discharged from clinic after completion of therapy. Utilization of LMWH, when alternate therapeutic options are not feasible, can be possible for dialysis patients. Laboratory monitoring with anti-Xa levels is essential to limit bleeding and thrombotic complications.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

5-027

**Category:** Cardiology / Anticoagulation

**Title:** Early experience with dabigatran at a large, tertiary care hospital

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**Purpose:** Dabigatran, an oral direct thrombin inhibitor on the market in October 2010, offers some potential advantages over traditional warfarin therapy. The fact that it is therapeutic within two hours of the first dose and it does not require laboratory monitoring are two of these advantages. Theoretically, these characteristics may lead to a shorter length of stay (LOS) for patients on dabigatran as compared to warfarin patients.

**Methods:** : Using the Premier outcomes data base, patients receiving either warfarin or dabigatran during a period from January to July 2011 were evaluated. To eliminate potential confounders, the groups were limited to patients with diagnoses related to cardiac dysrhythmias. Using the data base, patients were evaluated for length of stay, complication rates, and mortality. A secondary evaluation was conducted to evaluate readmissions for both of the groups.

**Results:** : During the study period, 46 patients with a primary diagnosis of cardiac dysrhythmias received dabigatran and 275 patients received warfarin. Using the database, length of stay was found to be significantly less for patients receiving dabigatran (6.64 days for warfarin vs. 4.10 days with dabigatran). Overall complication rates were also significantly lower for dabigatran. With regards to hemorrhagic complications, 6.52% of dabigatran patients had bleeding complications reported versus 10.88% of patients receiving warfarin. Readmission rates were also more favorable for dabigatran with 22.73% of patients being readmitted in the dabigatran group versus 34.01% of warfarin patients. Of note, none of the dabigatran patients were readmitted with either bleeding or thrombotic complications. However, 9 warfarin patients were readmitted with bleeding or thrombotic complications, specifically graft occlusions, cerebral artery occlusions, intracranial hemorrhage, and gastrointestinal bleeding.

**Conclusion:** As compared to warfarin, dabigatran is associated with a shorter length of stay, as well as fewer complications, and fewer readmissions.

5-028

**Category:** Cardiology / Anticoagulation

**Title:** Anticoagulation management and valvular thrombosis in a toddler: a case report

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**Purpose:** This case illustrates many challenges in managing anticoagulation therapy in a pediatric patient. A 7.5-kilogram (kg) toddler with Shones Complex required mitral valve replacement at 12 months of age (St. Jude mechanical, bileaflet prosthesis). Long-term anticoagulation therapy with warfarin (INR goal 2.5-3.5) was initiated by a pediatric cardiologist, and the patient was referred for outpatient anticoagulation management by our established outpatient pharmacy clinic. Point-of-care (POC) INR testing is routinely utilized using an i-STAT device. The first 4 weeks of monitoring exhibited unstable INR levels ranging from 2.2 to 5.27 (over 7 visits) with average weekly doses of 10-14 milligrams (mg). Several factors influenced INR including growth, dietary alterations, intermittent viral illness and potentially antibiotic therapy. During weeks 4-6, INRs began to stabilize on a dose of 12mg per week, with 2 consecutive therapeutic INR readings. Six days after an INR reading of 2.7, the patient displayed tachypnea, anorexia and oliguria and evaluation by a pediatrician prompted hospital admission. Diagnosis of a mitral valve thrombus was made through echocardiogram evaluation (marked echogenicity with an increased gradient of 30mm Hg). Subsequent tissue plasminogen activator (tPA) infusion of 0.3 mg/kg/hr (decreased to 0.15 mg/kg/hr) over 24 hours resolved thrombosis with improvement of valvular function/ gradient. INR on admission was suprathereapeutic at 5.18 by venipuncture, but was likely in response to acute right heart failure and hepatic congestion. The thrombus was presumed to be secondary to inadequate INR range, and the therapeutic goal was increased to 3-4. Home INR monitoring was initiated to allow for closer INR management. One week after hospital discharge, a suprathereapeutic home INR result was treated with oral vitamin K by an on-call hematologist. Resultant subtherapeutic INR level required hospital admission for heparin bridging. Correlation of hospital venipuncture to home INR tests demonstrated significant discrepancy. Pharmacist-managed anticoagulation was resumed upon hospital discharge, pending evaluation of home monitoring. Periodic assessment using simultaneous methods (home monitor, clinic POC, and venipuncture) was performed over the following 4 months with INR ranging from 3.4 to 7.04. Weekly dosage is relatively stable at 15.5mg. No further thrombotic events occurred and the patient has not exhibited any major bleeding over the entire treatment course. Venipuncture and clinic POC correlation improved as INR stabilized. However, home monitor levels remain an average of 2.1 units higher than clinic POC results. As this case suggests, there are several challenges with the management of anticoagulation therapy in the pediatric patient. Due to a lack of evidence, current therapeutic INR ranges for children are extrapolated from adult recommendations, despite distinct physiologic and pharmacodynamic differences. Although studies in children comparing POC

monitors to venipuncture INRs have confirmed their accuracy and reliability, this case illustrates otherwise. Subsequently, anticoagulation therapy in pediatric patients requires vigilant monitoring by experienced clinicians and laboratory correlation is recommended.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

5-029

**Category:** Cardiology / Anticoagulation

**Title:** Tirofiban Use in a Community-Based Hospital

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**Purpose:** In October 2011, Baptist Hospital changed its formulary from eptifibatide to tirofiban as the preferred IIb/IIIa agent for the treatment of acute coronary syndromes. The objective is to evaluate the use of tirofiban at Baptist Hospital.

**Methods:** Patients were identified by tirofiban charges through the pharmacy system. Medical records were retrospectively reviewed. Patient demographics were recorded (age, weight, initial serum creatinine, procedure, hemoglobin, hematocrit, and platelets). Medical records were also reviewed for adverse reactions/events.

**Results:** 19 patients (14 male) received tirofiban. The average age was 53 years and the average weight was 76 kg. The average initial serum creatinine was 1 mg/dL. The main procedures performed were heart catheterization (5) or percutaneous transluminal coronary angiography (PCTA) with a drug eluting stent (DES) (11). There were two patients who received intervention twice during the same hospitalization. Other procedures included a peripheral angiography with an arterial atherectomy. There was one instance in which the patient has extensive coronary artery disease and was not a candidate for invasive intervention. The patient received tirofiban as for medical treatment. The average hemoglobin, hematocrit, and platelet count were 12.7gm/dL, 37.9%, and 175.2, respectively. There was no documentation of any bleed or patient have receiving a blood transfusion during their admission.

**Conclusion:** Tirofiban use at Baptist Hospital was appropriate in all cases evaluated. There was no instance of adverse reactions/events.

**5-030**

**Category:** Cardiology / Anticoagulation

**Title:** Implementation of a heart failure readmission reduction initiative in a rural healthcare system

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**Purpose:** The Center for Medicare and Medicaid Services (CMS) has introduced a measure addressing heart failure readmissions. Through the Patient Protection and Affordable Care Act, beginning in 2013 CMS will be able to decrease reimbursements to hospitals that have higher than expected 30-day heart failure readmission rates. In an effort to be compliant with CMS reimbursement requirements, our institution established a Heart Failure Readmission Reduction Team. The team consisted of physicians, pharmacists, nurses, and administrators from the inpatient and outpatient settings. Our institution is a Pioneer Accountable Care Organization with six affiliated primary care clinics. Through a multidisciplinary approach, the goal of the initiative was to improve patient care, decrease heart failure readmissions, improve continuity of care, and reduce the financial burden on the medical center, primary care clinics, and surrounding rural communities.

**Methods:** The Heart Failure Readmission Reduction Team followed the continuum of care model. The pharmacy department was responsible for educating patients and establishing a screening criterion to better target heart failure patients. Patients were targeted for education if they were on the cardiac telemetry unit, had a left ventricular ejection fraction less than or equal to 40 percent, and had a primary care provider within an affiliated provider group. Patients with hospice care, cognitive barriers, or communication barriers were not educated. The team developed patient education tools in an effort to improve patient understanding of the disease, medications, and recommended lifestyle modifications. During educational sessions, a pharmacist discussed with each patient heart failure symptoms and pharmacologic and nonpharmacologic methods for reducing the severity and frequency of these symptoms. At the end of each session, patients received an educational brochure, along with a weight and blood pressure log. Patients were encouraged to take their blood pressure and weight on a daily basis and to notify their primary care provider of any significant changes. The pharmacist then communicated any pertinent information and recommendations to inpatient clinicians, outpatient primary care providers, and/or outpatient nurse care managers. Data was collected to evaluate the impact of the interventions on our institutions 30-day heart failure readmission rate.

**Results:** From September 26, 2011 through April 30, 2012, pharmacists screened 761 patients and educated 68 patients (8.9 percent). However, during the month of April alone, 17.4 percent of patients screened were educated. Prior to this initiative, from 2007 through 2011, the 30-day

heart failure readmission rates for the hospital ranged from 18.5 to 22.4 percent. After the project was initiated, the 30-day heart failure readmission rate fell to 15.5 percent in the first quarter of 2012.

**Conclusion:** Pharmacists play an integral role within an interdisciplinary team in educating heart failure patients, enhancing continuity of care, decreasing readmission rates, and improving reimbursement rates.

5-031

**Category:** Cardiology / Anticoagulation

**Title:** Implementation of a pharmacist-driven anticoagulation discharge counseling process at an academic medical center

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**Purpose:** The Joint Commission National Patient Safety Goal (NPSG) 03.05.01 has challenged acute care centers to reduce the likelihood of patient harm associated with the use of anticoagulant therapy. One element for performance of NPSG 03.05.01 is to ensure patients/family receive proper education of anticoagulation therapy including: the importance of follow-up monitoring, compliance, food-drug interactions and the potential for adverse drug reactions and interactions. In addition, the Centers for Medicare and Medicaid Services (CMS) is in the initial stages of providing financial incentives to acute care centers that can demonstrate meaningful use of Electronic Health Record (EHR) technology. The primary measurable outcome for Meaningful Use Stage 1 is the ability to record and report clinical quality measures (CQM). Clinical quality measure 14 requires eligible acute care centers to ensure all patients diagnosed with a venous thromboembolism (VTE) discharged on warfarin receive written instructions prior to discharge. This project was designed to define the pharmacists role in the discharge process thereby ensuring compliance with national goals and placing the academic medical center in a position to capture financial incentives related to anticoagulation therapy.

**Methods:** The Department of Pharmacy (DOP) used NPSG 03.05.01 and Clinical Quality Measure 14 terminology to define patients requiring anticoagulation discharge counseling. Once the definition of compliance was established, DOP Leadership worked collaboratively with the Information Security Department to develop a compliance report which would accurately reflect rates of discharge counseling documentation completion. The compliance data was reported in a service-specific fashion to allow individual feedback to practitioners. A committee of pharmacists was also established to standardize educational materials and to develop procedures for identifying, counseling and documenting the process. After a two week pilot, the DOP began to take responsibility for anticoagulation discharge counseling in a phased approach over an eight week period. Of note, prior to the DOP taking an active role in the anticoagulation discharge counseling process (August 2011), this responsibility was handled by nursing colleagues. Following the completion of the pilot, a comparison of compliance rates was made between anticoagulation discharge counseling completed by pharmacy versus nursing staff.

**Results:** Compliance rates have been tracked on a monthly basis since January 1, 2010. Prior to August 2011 when nursing colleagues were responsible for anticoagulation discharge counseling, the average monthly compliance rate was 55.5% (range: 30.8%-76.11%). From

August 2011 through March 2012, the average monthly compliance rate increased to 75.75% (range: 64.97%-84.87%) following the DOP assuming primary responsibility for anticoagulation discharge counseling. The pharmacist-driven anticoagulation discharge counseling process resulted in a 20.25% increase in institutional compliance

**Conclusion:** The implementation of a pharmacist-driven anticoagulation discharge counseling process resulted in a sustained and substantial increase in compliance rates. The pharmacist role in the discharge process has enhanced the institutions compliance with NPSG 03.05.01 and position to receive financial incentives by demonstrating meaningful use of EHR technology.

5-032

**Category:** Cardiology / Anticoagulation

**Title:** Difference in Initial Activated Clotting Time after Bivalirudin Bolus during PCI in Obese versus Non-Obese Patients

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**Purpose:** Bivalirudin is a direct thrombin inhibitor frequently used during cardiac catheterization when percutaneous coronary intervention (PCI) is performed. The initial bolus and maintenance infusion of bivalirudin is weight-based. To date, the relationship between the ACT achieved following the initial bolus in obese versus non-obese patients has not been widely studied.

**Methods:** This retrospective chart review was approved by the Institutional Review Board of WakeMed Health & Hospitals. Patients who received bivalirudin during PCI were included. Patients were excluded if they received fibrinolytic therapy or GP IIb/IIIa inhibitors before or during catheterization, or if they received heparin during catheterization. The primary objective was to compare the initial ACT following a 0.75 mg/kg bolus of bivalirudin between obese and non-obese PCI patients. Secondary objectives were to quantify and evaluate any bleeding or thrombotic event that occurred after catheterization, and to quantify and evaluate 30-day readmissions for bleeding or thrombotic events.

**Results:** Patients were divided into treatment groups by body mass index (BMI): 53 patients were non-obese (BMI <30 kg/m<sup>2</sup>); 47 patients were obese (BMI > 30 kg/m<sup>2</sup>). Aside from BMI and age, baseline demographics were similar between groups. Median ACT in the obese group was higher at 365 seconds compared to 352 seconds in the non-obese group (p=0.04). In the obese group, four patients experienced a bleeding event and four others had elevated cardiac enzymes after PCI; two were documented myocardial infarctions. In the non-obese group three patients experienced bleeding events.

**Conclusion:** Initial ACTs following a bivalirudin bolus are significantly higher in obese patients. This indicates that further investigation is warranted for this topic. Bleeding and thrombotic outcomes associated with total-body-weight-based bivalirudin dosing need to be evaluated prospectively.

5-033

**Category:** Chronic / Managed Care

**Title:** The Impact of Pharmacist Involvement in Associate Benefit Design Programs

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**Purpose:** Sisters of Charity of Leavenworth Health System (SCLHS) and Exempla Health is made up of 11 hospitals across the states of Colorado, California, Kansas and Montana. SCLHS/Exempla covers 12,068 and 7168 lives under its employee health benefit, respectively (excluding California). In 2010 SCLHS/Exempla spent over \$15 million on prescription medications (\$7 million in mail order). SCLHS/Exempla, like most health systems, are exploring new approaches to ensuring our beneficiaries all receive the most cost effective care as well as reducing costs to our health plan without reducing access to needed healthcare services. It is no longer enough to delegate pharmacy management to your pharmacy benefit manager (PBM): collaboration with inpatient pharmacy is key to success. Working closely with our PBM SCLHS believed we could increase the likelihood that we will meet our objectives improving our employees health outcomes as well as for lowering costs. Inpatient pharmacy leadership is being called on to assist with identification of these approaches.

**Methods:** In February 2011 our first combined system Employee Pharmacy & Therapeutics Committee met. Members on this team representing pharmacy included 2 of the inpatient pharmacy directors, outpatient infusion pharmacy manager and the system director of pharmacy. The team has proposed that: the plan cover medications that are effective in treating patients by improving significant clinical outcomes and reducing overall medical costs; Encourage prescribers to select medications that are in accordance with an evidence-based practice of medicine; Improve access to specialty pharmacy services by internalizing the service and enhancing our ability to provide direct care for our beneficiaries and leverage volume, safety, and price as well as enroll beneficiaries in prescription assistance programs; Monitor and encourage patient adherence with drug therapies focusing on areas where opportunity for improvement was identified; Monitor employee drug usage for over- and under-utilization; and Promote prudent utilization of pharmaceuticals by plan members with benefit designs that provide a mixture of incentives and disincentives to facilitate access and support cost- and quality-effective choices

**Results:** An internal specialty pharmacy was opened in February 2012. The team has been also able to determine what medications are over-utilized, under-utilized or inappropriately utilized and strategies have been developed. These results will be presented.

**Conclusion:** Inpatient pharmacy leadership can add tremendous value to the pharmacy employee benefit. A sound pharmacy benefit strategy can result in an employee population that experiences less illness, fewer hospital stays, a lower incidence of surgery, greater productivity and a higher quality of life. By including these leaders in employee pharmacy benefit other ideas can be identified for improving outcomes and lowering costs to our employees drug costs. Future objectives will include more targeted disease state management and targeting medication therapy management work on our beneficiaries with other chronic disease and polypharmacy.

5-034

**Category:** Clinical Service Management

**Title:** Integration of value added clinical responsibilities for decentralized unit based pharmacists in a community hospital setting

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**Purpose:** Northeast Health System utilizes decentralized unit based pharmacists to more readily clarify and process patient medications as they are ordered by prescribing health care providers. This project describes clinical responsibilities that have been established in addition to the medication verification duties of the unit based pharmacists to help enhance overall quality and safety of patient care as well as to assist in meeting various mandated initiatives and guidelines as set forth by such organizations as Center for Medicare and Medicaid Services (CMS), the Joint Commission, American Society of Health Care Pharmacists (ASHP), and the Institute for Safe medication Practice (ISMP).

**Methods:** Clinical initiatives were gradually introduced into the medication verification duties of the decentralized unit based staff pharmacists on the medical/surgical, pediatric, and critical care units of Beverly Hospital. First an IV to PO collaborative practice program on a predetermined list of appropriate target medications was introduced to review for appropriate therapeutic interchange from IV to oral form. Next an anticoagulation initiative was developed. These medications were reviewed for appropriate indication, dose adjustment or change based on renal function, and elevated INR values where applicable. In addition, patient education and discharge counseling on anticoagulation medications were provided to improve compliance and decrease our re-admission rate. An antimicrobial stewardship program was then introduced. Vancomycin and aminoglycoside monitoring as well as a pharmacy based pharmacokinetic consult service were instituted as a result of a few cases of renal toxicity among inpatients receiving these medications. Unit based pharmacists were also encouraged to attend multidisciplinary rounds.

**Results:** Since the implementation of the decentralized unit based pharmacy program, overall clinical interventions increased from 550 to over 1200 per month. In addition, average monthly discharged patient medication counselings increased from less than 10 to 30. The pharmacy targeted IV to oral medication conversion initiative resulted in an increase from 20 to 80 interchanges per month. Furthermore, attending multidisciplinary rounds has resulted in an increased efficiency in resolving medication related issues as well as promoting a closer interdisciplinary relationship with our fellow hospital colleagues.

**Conclusion:** Clinical responsibilities such as increased emphasis on discharged patient counseling, IV/PO interchanges, antimicrobial stewardship, anticoagulation and key laboratory

values monitoring can be successfully integrated into the daily medication processing duties of decentralized unit based pharmacists within a community hospital. This provides a cost-effective way of enhancing medication safety and improving patient care with no adverse impact on existing pharmacy staffing resources.

5-035

**Category:** Clinical Service Management

**Title:** Implementation of a pharmacy driven inpatient diabetes service improves inpatient glycemic control

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**Purpose:** Maintenance of adequate glycemic control in inpatients is associated with improved patient outcomes, reduced complications, decreased mortality, and reductions in hospital stay. We implemented hospital-wide changes to diabetes management, including daily pharmacist medication therapy management interventions. This report describes results of daily pharmacist management in improving glycemic control at a large community hospital in Sacramento, California.

**Methods:** Pharmacists were part of a multidisciplinary taskforce charged with improving glycemic control throughout the hospital. One of the strategies was to implement a practice of having pharmacists review inpatients with less than optimal glycemic control, defined as any two blood glucose concentrations (BG) greater than 200 mg/dL or one less than 70 mg/dL. The review was performed on a daily basis for three hours per day. Pharmacist interventions focused on recommending addition of, or adjustment to, a subcutaneous basal / bolus insulin regimen, as recommended by the American Association of Clinical Endocrinologists (AAACE) and American Diabetes Association (ADA) Consensus Statement on Inpatient Glycemic Control. The success of the pharmacist interventions was measured through use of the electronic health record (EHR). On a monthly basis, all patients receiving any antihyperglycemic agents during a one week period were included in an analysis. Patient blood glucose levels (from point-of-care testing and blood glucose draws) entered into the EHR were used to calculate the percentage of patients in the hospital who received at least one dose of the antihyperglycemic agent and then had a BG over 299 mg/dL or under 70 mg/dL. The results for a baseline month prior to implementation were compared to the results post-implementation.

**Results:** There was a decrease in the rate of hyperglycemia for baseline vs. post-implementation (37/100 (37%) and 18/98 (18%) for the baseline and post-implementation, respectively;  $P = 0.0035$ ). There was no change in the rate of hypoglycemia.

**Conclusion:** Daily pharmacist interventions improved glycemic control as measured by hyperglycemia. Additional actions are needed to affect the rate of hypoglycemia.

5-036

**Category:** Clinical Service Management

**Title:** Successful credentialing and privileging of pharmacists in a community hospital

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**Purpose:** The pharmacy practice model initiative (PPMI) recommendations include credentialing and privileging of pharmacists to expand their scope of practice. The objective of this poster is to describe the process of successfully credentialing and privileging each of our pharmacists at our institution.

**Methods:** The pharmacy leadership worked with the credentialing office to define core privileges based on skills that each pharmacist must demonstrate as part of their training. Core privileges include documenting in the patients electronic medical record; preparing pharmaceuticals; patient counseling; implementing and managing drug protocols; identifying and taking corrective action to monitor, prevent, reduce or correct drug induced problems; serve as a clinic consultant for drug and drug-related programs in the clinics and/or on the wards; taking medication histories; and providing health care professional education. Pharmacists were required to provide licensure and continuing education information to the credentialing office as well as peer references to verify the required skills. Specialist pharmacists who practice in ambulatory care, oncology, and acute clinical pharmacy have additional privileges that reflect their expanded scope of practice and include the authority to prescribe medication in accordance with collaborative practice agreements. Pharmacists will have the ability to apply for additional privileges separately as they complete additional training and certification programs.

**Results:** Forty-nine pharmacists were privileged by the hospital credentialing committee in accordance with hospital regulations. Of the 49 pharmacists, two have expanded privileges in the area of hematology and oncology and eleven have expanded privileges as clinical pharmacists allowing them to prescribe medications.

**Conclusion:** A privileging process allowing pharmacists to have core privileges within a hospital system allows for others to recognize the pharmacists status as a health care provider on the interdisciplinary patient care team. Allowing specialist pharmacists to have expanded privileges in accordance with their training and expertise provides an avenue for prescribing authority in accordance with collaborative practice agreements.

5-037

**Category:** Clinical Service Management

**Title:** Continuity of care: an innovative approach to an advanced pharmacy practice experience within a large community hospital

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**Purpose:** The role of institutional pharmacy in providing both central distributive functions and expanded clinical services is continuously evolving. Therefore, institutions are finding creative ways to maximize job functions for current staff in order to meet the challenges faced by the modern pharmacist practitioners. Student pharmacists, by their final year clerkships, have acquired a wealth of knowledge in pharmaceutical care. Therefore the utilization of student pharmacists with clinical functions in the institutional setting aids both the student in providing real life experiences and the institution in optimizing staffing resources. In order to adhere to the revised standards from ACPE (American Council for Pharmacy Education) it is essential that student pharmacist are exposed to direct patient care in pharmacy practice experiences. As stated in the 2008 ACCP White Paper entitled Quality Experiential Education, institutions should strategize innovative training models, including continuity of care throughout different health-care settings. . In response to this challenge, an Internal Medicine APPE (Advanced Practice Pharmacy Experience) rotation provided student pharmacists a real-life, continuity of care experience throughout various stages in a patients hospital stay at a non-academic affiliated hospital setting. This new approach was performed to enhance the quality and quantity of interventions by the pharmacy department, without disruption in current pharmacist staffing.

**Methods:** Pharmacists from all three disciplines of central, unit-based, and clinical met to assess their current Internal Medicine APPE rotation in order to develop a new module to provide a student pharmacist with appropriate learning experiences and still allow the preceptor pharmacists to handle their normal responsibilities. The outcome was a new concept in providing an APPE rotation that would allow the student to have not only direct patient care but would also allow them to be involved in the patients continuity of care throughout their admission. The new rotation is under the preceptorship of a clinical pharmacist with the Emergency Department (ED) pharmacist and central team leader pharmacist as co-preceptors. The first component of the rotation is built around the student collaborating with the ED pharmacist to access patients by detailed medication reconciliations to pin-point any pharmaceutical issues. At this time the student is to develop a relationship with the patient, if applicable. With the ED pharmacist guidance the student will be assigned admitted patients to follow throughout their hospital stay. This is performed one to two days each week. Once the students are assigned patients, the clinical pharmacist will continue the learning experiences following the patients care until discharge. The student will perform daily rounds in which the student is encouraged to speak to the patients concerning any new medication additions/deletion and in the afternoon the student

will perform a patient presentation at which time the student will discuss all possible interventions with the preceptor. During daily rounds the formal medication consultations will occur at this time. Other student activities include journal clubs, topic discussions and a formal in-service presentation to the whole pharmacy department.

**Results:** To date, four 4th year pharmacy students have completed the new rotation. The results have been positive for both the student pharmacists and the institution. For the institution, students have completed 180 interventions consisting of drug information, IV to PO switches, medication reconciliations, MDI education, antibiotic monitoring and de-escalation, ADR reporting and both staff and patient education. One notable intervention occurred when a statin induced myopathy was identified by the student after reviewing the patients medications and symptoms from the ED admit. For the student, they have experienced direct patient care that begins during the admission and continues until discharge. To assure continued success and improvements on the rotation, a process evaluation was implemented to obtain feedback on the rotation contents and structure

**Conclusion:** By collaborating with different disciplines within the pharmacy department, an innovative approach to providing an Internal Medicine APPE was created. This new rotation results in a positive experience for the student and the institution and directly impacts the care a patient receives at this non-profit acute care hospital.

**5-038**

**Category:** Clinical Service Management

**Title:** Evolution of the role of pharmacy in optimization of transitions of care in heart failure patients

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**Purpose:** Elements of transitions of care are not new concepts: the importance of medication reconciliation at both admission and discharge, patient education in the hospital setting, and counseling for discharge were areas of opportunity addressed years earlier. Defined as the movement of patients from one healthcare setting or practitioner to another, as the condition of the patient or the level of care needed changes, transitions of care had recently become a focal point; it is generally said to have been driven by imminent changes in CMS reimbursement related to readmissions. Transitional care provides a contiguous perspective of the entirety of the patient care process, integrating all components with the objective of ensuring patient transition in a seamless and optimized manner. Necessarily, it bridges the ambulatory care setting to the inpatient setting and then back to the home or another facility in the ambulatory care setting. As executed at this institution, it includes optimizing admission, planning for chronic disease management, preparing for discharge on or shortly after admission, optimization of inpatient stay, and ensuring connection to the patients home, post discharge. Efforts toward reduction in readmissions at this 394 bed urban safety net hospital was initiated with a pilot program in February 2011, with a pharmacist incorporated into the multi-disciplinary team, including representatives from medicine, nursing, social work, and dietary. Pharmacy leadership set expectations for the department. Pharmacist tasks were modularized and specific components of the process were reassigned as time elapsed, resulting in variable iterations, to meet the departmental needs. Advanced Pharmacy Practice Experience (APPE) students were incorporated into the process, serving in part as extenders, working with medication histories. The purpose of this study was to determine the extent of pharmacist interventions; also, to examine the overall and relative effectiveness of the iterations of the process utilized.

**Methods:** The process measurement was delineated into three phases: the pilot, the phase coordinated by PGY1 residents with clinical pharmacists secondarily, and lastly the current hybrid phase which uses a coordinated effort between clinical pharmacists and residents. To examine the impact of pharmacist participation, key steps in the process were measured for all admissions in each of the three groups: medication history and reconciliation; patient education,; discharge reconciliation and counseling; and post-discharge calls to the patient. Information is routinely recorded onto a data collection form by pharmacists providing care. For the purposes of this evaluation, this data was retrospectively evaluated for consecutive admissions.

**Results:** The three phases extended for variable durations, with varying numbers of patients: the pilot phase (6 months) covered 62 admissions and 51 patients; the phase coordinated by PGY1 residents (8 months) covered 115 admissions and 110 patients, and the current hybrid phase which uses a coordinated effort between clinical pharmacists and residents (1 month) covered 14 admissions and 12 patients. The number of interventions completed in the pilot, resident coordinated, and current hybrid phases, respectively, were medication history / reconciliation 58, 67, and 12; patient education sessions 42, 64, and 12; discharge reconciliation 22, 97, and 12; and post-discharge phone calls to patients 38, 98, and 14. Overall, the rate of heart failure interventions was 3.65 per admission, with delineated intervention rates of 3.32, 3.76, and 3.93 in the pilot, resident coordinated, and current hybrid phase, respectively.

**Conclusion:** In the care of 191 admissions, a substantial number of interventions were executed by pharmacists: starting from a baseline of essentially nil, increasing to a total of 655 interventions related to heart failure over the entire study period. Results indicate that the number of interventions per patient increased over the course of study, starting at 3.3e per admission in the pilot, which had less access to staff, up to 3.93 in the current hybrid model. Notably, the current model has been in existence for only 1 month; therefore, these numbers will continue to be closely monitored. Ultimately, the focus is outcome. The multidisciplinary team significantly and consistently impacted readmissions: a decrease in the 30 day heart failure readmission rates was demonstrated, with a decline from 17.6% to 7.8%. Although it is difficult to isolate the contributions of specific team professionals, it is generally recognized that heart failure is a disease that is heavily medication-centric. The multidisciplinary team worked together seamlessly, meeting often and communicating frequently. The need to strengthen the connection to the ambulatory care setting was notable. The team was confronted with limited functionality in communicating with non-affiliated clinics and independent practitioners. Clearly, this is an area warranting further study and effort, in order to ensure optimal care for patients not incorporated into the system. Efforts early in the program resulted in the addition of two clinical staff pharmacists; these positions were just recently integrated into the staff in order to expand departmental contributions to the transitions of care. Demonstration of continued impact resulted in the very recent granting of a half-time ambulatory care position. Next steps include the imminent expansion to diseases beyond heart failure, thereby optimizing care for a far greater number of patients.

5-039

**Category:** Clinical Service Management

**Title:** Novel PGY1 residency learning experience encompasses health system's pharmacist role in the transitions of care

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**Purpose:** The transitions of care, as a concrete expectation, has recently been introduced to healthcare as a contiguous concept. It encompasses the body of accumulated knowledge addressing the steps necessary to optimize care of the patient. Care transitions bridge the ambulatory care setting to the inpatient setting and then back to the home, often in the ambulatory care setting. Each step in this sequence warrants evaluation and possibly action by a pharmacist, especially for high risk patients. Involvement in the transitional care efforts in the reduction of heart failure readmissions at this 394 bed safety-net hospital was initiated with a pilot program integrating a multi-disciplinary team, which included pharmacy. Over several months during the pilot, pharmacy leadership was able to construct expectations for pharmacists, based on pre-defined steps. The transition of care flow, as defined at this institution, evolved over a several month period as pharmacy leadership evaluated the utility of various options; the flow involves several key interactions of pharmacists with patients and other professionals. The opportunity for patient interactions and interactions with multiple professionals, compounded with exposure to a critical new practice area, compelled departmental leadership to develop a Transitions of Care longitudinal PGY1 learning experience. Exposure to patients moving from pre-admission, through admission and multiple levels of care, and finally post discharge when they are confronted with their home setting, was deemed a worthwhile effort in both optimizing patient management and providing compelling content for a PGY1 learning experience. Residents would be able to initiate and maintain relationships with heart failure patients; analogous to an ambulatory care experience, this experience facilitated the establishment and maintenance of relationships with patients over time. Further, residents would be able to develop their skills in overseeing Advanced Pharmacy Practice Experience (APPE) students, as the students were involved with medication histories. The primary objective of this evaluation was to establish whether patients were successfully managed by the residents; surrogate markers, intervention counts, were established. Secondly, the objective was to ascertain whether PGY1 goals and objectives were appropriately met, as reflected by resident evaluations and self-assessments.

**Methods:** In the development of the PGY1 learning experience, the same ASHP residency goals and objectives as were developed for the Ambulatory Care longitudinal learning experience, were assigned to the Transitions of Care longitudinal learning experience. Goals assigned to the

learning experience are listed: R1.4 Demonstrate ownership of and responsibility for the welfare of the patient by performing all necessary aspects of the medication-use system; R2.1 As appropriate, establish collaborative professional relationships with members of the health care team; R2.2 Place practice priority on the delivery of patient-centered care to patients; R2.3 As appropriate, establish collaborative professional pharmacist-patient relationships; R2.4 Collect and analyze patient information; R2.11 Communicate ongoing patient information; R2.12 Document direct patient care activities appropriately; R5.1 Provide effective medication and practice-related education, training, or counseling to patients, caregivers, health care professionals, and the public. Unlike most other longitudinal rotations, a set time was not established; rather, the resident developed skills in planning and organizing time, in order to meet the needs of the program. To assess the learning experience provided, resident evaluations were to be reviewed. The steps involved in transitions of care at this institution had been delineated, defined, and modularized. Multiple data points related to care of the patient by pharmacists, any observations or actions taken by a pharmacist were routinely documented onto the data collection tool, developed during the program pilot. This data was examined retrospectively, to evaluate the effectiveness, including the number of medication histories, reconciliations, educational sessions, inpatient pharmacotherapy interventions, discharge reconciliations, and post-discharge follow-up calls to the patient. The sum and rate of interventions accomplished by residents was to be compared to those accomplished during the pilot, with pharmacists.

**Results:** Firstly, the residents are in the process of completing the learning experience, and the residency. The resident evaluations reflect professional growth. Descriptions, detailed by the residents, indicate opportunities professional satisfaction with comprehensively caring for heart failure patients, extending care into the home of the patient subsequent to discharge; opportunities for communication and collaboration with patients and health care providers over time; organization and management of time; and organization of varied patient data, including lab values, medications and signs/symptoms. Secondly, in regards to patient care: two residents, over the course of 8 months, managed 115 admissions and executed 432 interventions over 9 months. The majority of admissions were one time; however, repeat admissions were not uncommon. The rate of interventions, per admission, was 3.8 per admission. This is a substantial increase in comparison to the rate of interventions during the pilot phase, which was 3.32 per admission.

**Conclusion:** Substantial contributions of the residents to team efforts have been demonstrated in terms of the number of resident interventions, with the ultimate impact of contribution to a reduction in 30-day heart failure readmission from 17.8% to 7.3% as part of a team. Process measures confirm the effectiveness of residents, in conjunction with clinical pharmacists secondarily. The rate of interventions accomplished by residents was higher than the pilot group: 3.76 vs. 3.32 per admission. Benefits yielded by the residents included initiation and maintenance of relationships with patients over time; maintenance of relationships with healthcare professionals over time. Also, development of time and organization skills was a notable component of the experiences, as self-identified by residents. Further, an essential achievement was the attainment of understanding of the patient in the ambulatory setting and the experience and skills to navigate the inpatient to outpatient interfaces. This institutions PGY1 residency seeks to expose its residents to scenarios that enable practice in both todays and future

environments. We have concluded that resident participation in this novel longitudinal experience was successful, strengthening the professional skills of the PGY1 residents on multiple levels. Novel experiences can meet the requirements for a PGY1 learning experience, possibly even exceeding expectations by offering direct insight in vital and emerging practice areas.

**5-040**

**Category:** Clinical Service Management

**Title:** Glycemic evaluation and feasibility of collaborative practice model for colorectal surgery patients

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**Purpose:** To describe glycemic control within a colorectal surgery practice and then outcomes after implementation of pharmacist led glucose management program within a Collaborative Practice Agreement (CPA) between pharmacists and surgeons in a colorectal surgical practice as a feasibility pilot.

**Methods:** A retrospective review of glycemic control in a single institution colorectal practice Glucose management with CPA within an inpatient surgery practice. Implementation of CPA gave decision rights to the pharmacists to make medication management decisions and adjust orders without the explicit approval from the surgical service. Outcomes assessed include glucose levels, pharmacist involvement and utilization of resources.

**Results:** Surgical patients from one hospital at Mayo Clinic included 505 colorectal surgery inpatient admissions Nov 2009 through December 31, 2011. One hundred seventy four of 505 had glucose > 150 within the first 48 hours postoperatively demonstrating need. In the feasibility pilot, patients with CPA and had glucose managed by the pharmacist partnering with the nursing staff and surgical team, glucose levels were similar and with lower resource utilization of the when compared to non-CPA patients within the same pharmacist team and a comparable surgical practice.

**Conclusion:** Glucose levels maintain above goal in colorectal surgery patients. Pharmacist interventions to improve medication safety and efficacy normally occur, but CPA allowed for increased accuracy and efficiency in managing glucose control. This additional service has further highlighted the value the pharmacist brings to the colorectal practice. Establishing pharmacist led glucose management within CPA as a new organizational design represents one model to improve glucose management in hospitalized colorectal surgical patients. CPA allows expansion of value-added pharmacist services and may be readily implemented in other high functioning teams.

**5-041**

**Category:** Clinical Service Management

**Title:** Application of an interdisciplinary protocol to successfully convert enterally incompatible drugs with enteral nutrition from the intravenous or inappropriate enteral route to an appropriate enteral administration time in critical care tube fed patients at a major medical center.

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**Purpose:** Intravenous to oral step-down of medications has been a cost-effective, convenient and safe way to administer medications to hospitalized patients. Additionally, it has the potential to reduce length of stays, administration times, infusion reactions and infections. However, there are oral medications that are physically incompatible with tube feed formulas to allow for such an enteral step-down in therapy. The purpose of this study was to determine during 6 quarterly review periods between 2010 and 2011 whether an interdisciplinary protocol with tube-free intervals can allow conversion of enterally incompatible drugs given intravenously or enterally concurrent with continuous tube-feeds to an appropriate enteral administration.

**Methods:** The pharmacy and therapeutics committee and the nutrition-pharmacy committee approved the implementation of an interdisciplinary protocol allowing physically incompatible oral drugs with enteral nutrition (i.e. fluoroquinolones, levothyroxine) to be administered enterally at 10am during a 4 hour tube feed-free interval of 8am to 12 noon for single daily drug administrations and at 10pm during a 4 hour tube feed-free interval between 8pm and 12 midnight for every 12 hour drug administrations. Eligible patients included critical care unit (ICU) patients receiving continuous tube feed formulas (TF) with enteral tube administered medications for at least 2 days while also receiving a physically incompatible drug that was concurrently given intravenously or enterally. All approved enteral conversions of incompatible drugs were rewritten with hard-coded instructions to withhold the tube feeds for the specified 4 hours and administer the drug enterally at 10 am plus or minus 10pm. The nutritionist was instructed to increase the tube- feed rate to compensate for each 4 hour tube- free interval when the tube feeds were withheld. The covering nurse was informed about the drug conversion to the approved enteral administration and adjustment in the tube feed rate. The primary outcome was the percent of physically incompatible drugs successfully converted to the appropriate enteral formulation and time per quarter. The secondary outcome was the cost savings based on a 7 day review of the total number of enteral drug conversions per quarter and the cost savings of the total conversions for each enteral drug for the entire study.

**Results:** During the study period there were between 34 to 73 patients per quarter on continuous TF in the ICU or an average of 59 TF patients per quarter. This constituted an average of 26 percent of the total ICU population. The number of conversions of incompatible protocol drugs was between 7 and 19 per quarter or an average of 12 per quarter. The primary outcome of successful enteral conversions was 100 percent for 5 of the 6 quarters and 81 percent for one quarter. The secondary outcome demonstrated cost savings of all enteral drug conversion between \$777 and \$1500 per quarter or an average of \$975 per quarter. Also, the total cost saving of each of the enteral drug conversions for levothyroxine, voriconazole, fluoroquinolones, digoxin and phenytoin reviewed for the entire study was \$3376, \$1512, \$134, \$67 and \$26, respectively.

**Conclusion:** Use of an interdisciplinary protocol with 4 hour tube feed-free intervals is a feasible method to successfully convert patients from an intravenous route or from an inappropriate enteral administration to an appropriate administration time for drugs physically incompatible with enteral formulas. This protocol can improve patient care by assuring optimal bioavailability and therapeutic efficacy as well as cost savings for drugs commonly used in practice.

**5-042**

**Category:** Critical Care

**Title:** Wake up and wean protocol

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**Purpose:** Daily interruptions in sedation, known as Spontaneous Awakening Trials (SATs), paired with Spontaneous Breathing Trials (SBTs), can shorten the duration of mechanical ventilation, intensive care unit (ICU) and hospital lengths of stay; reduce the rates of complications such as barotrauma and ventilator associated pneumonia; and improve survival compared to patients in whom sedation is not temporarily interrupted. In November 2010, an 870 bed healthcare system, with 120 adult critical care beds, incorporated paired SATs with SBTs into its Critical Care Analgesia and Sedation Orderset for Adults. Based on retrospective audits conducted up to June 2011, SATs were performed in 32 to 43.5 percent of all eligible patient days and medication titrations did not adhere to orderset instructions. A quality improvement multidisciplinary team, involving physicians, nurses, respiratory therapists, and pharmacists, convened to design and implement changes. In February 2012, revisions to the Wake Up and Wean Protocol included: consolidation of the daily wake up times amongst the different adult ICUs, refinements to exclusion criteria for nurse SAT screens and re-sedation parameters, revisions to SAT medication adjustments, creation of electronic charting for SATs and SBT assessments, development of a Business Intelligence report to improve nursing accountability, consolidation of Medicine and Surgery SBT protocols, and updates to the extubation pass or fail criteria. The purpose of this project was to assess the institution's adherence to the SAT component of the Wake Up and Wean protocol after its implementation in February 2012 and subsequent upgrades in May 2012.

**Methods:** Two audits were conducted, March 12 to 23, 2012, and, later May 1 to June 10, 2012, to measure rates of SAT nursing assessment completion, adherence to the institution's orderset, the percentages of patients who completed a SAT screen and/or SAT, failed SAT screen, reasons for SAT screen failure, orderset use, and titration methods used to re-sedate patients. Data was collected in adult patients who received at least one continuous infusion analgesic or sedative medication.

**Results:** In March 2012, SATs were performed in 34 percent (43 of 127) of the 40 patients (127 patient days) studied and were excluded by SAT screen in 35 percent (45 of 127) of observations, resulting in a SAT accountability rate of 69 percent (88 of 127). The institution's orderset was used 80 percent of the time (102 of 127). The average time to re-sedation (SAT

failure) was 1.37 hours (0.17 to 9.1). Before a SAT could be conducted, nurses had to first determine if the patient met any exclusion criteria through a daily SAT screen. The four most common exclusion reasons were Do Not Resuscitate/Do Not Intubate orders (2), physician orders (4), sedation increases (14), and restlessness (21). The overall medication rate reduction before and after SATs was 10.7 percent. In May/June 2012, SATs were performed in 30 percent (157 of 530) of the 130 patients (530 patient days) studied, and were excluded by SAT screen in 22 percent (117 of 530) of observations, resulting in an SAT accountability rate of 52 percent (274 of 530). The orderset was used 72 percent of the time (382 of 530). The average time to re sedation was 8.9 hours (0.4 to 16). The four most common exclusion reasons were elevated intracranial pressure (10), presence of neuromuscular blockade (12), restlessness (21) and physician orders (41). The overall medication rate reduction before and after SATs was 25.8 percent.

**Conclusion:** After attempts to improve the SAT/SBT process, accountability to the protocol decreased from 69 percent in March to 52 percent in May/June. The rate of SATs performed remained steady (34 percent in March compared to 30 percent in May/June). One explanation for the decrease in SAT rate adherence could be due to the addition of a 44 bed critical care unit in the second analysis. Although the majority of medications were initiated by the orderset, no medications were decreased by 50 percent of the pre SAT rate as directed. The institutional goal for SAT screening is 90 percent. Further steps to improve nursing awareness, education, and adherence to SAT assessments are ongoing.

**5-043**

**Category:** Critical Care

**Title:** Continuous renal replacement therapy: moving practice forward with new technology

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**Purpose:** In December 2011, an 870 bed healthcare system, with 120 adult critical care beds, changed continuous renal replacement therapy (CRRT) systems from Gambro to NxStage. To accommodate the new machines, several modifications were made to dialysate and replacement fluids as well as anticoagulation parameters to prevent hemofilter occlusion. Therapy fluid options were reduced from ten to three, two standardized premixed formulas (RFP 400 [KCl 2 mEq/L] and RFP 401 [KCl 4 mEq/L]), and one customizable formula (RFP 402 [KCl 0 mEq/L]). Customized additives were streamlined from four electrolytes to three (potassium chloride, magnesium sulfate, and sodium phosphate). An analysis was performed to determine the following: frequency and volume of pharmacy prepared CRRT fluids, types of customized CRRT fluids ordered, modalities of CRRT (continuous venovenous hemofiltration (CVVH) or continuous venovenous hemodialysis (CVVHD)), ability of the institution's low dose heparin regimen to maintain a desired activated partial thromboplastin time (APTT) less than 46 seconds (secs), frequency with which bivalirudin was ordered, and bivalirudin's dose response to achieve desired APTT goal ranges of 1 to 1.4 above the baseline APTT.

**Methods:** Retrospective, observational data was collected over a 5 month period, from 12/13/2011 to 5/11/2012. A weekday report showing the distribution of CRRT machines was used to identify patients. Information regarding weekend CRRT usage was excluded. The following information was retrieved: admission weight, discharge diagnosis, dialysis start and stop times, CRRT mode (CVVH or CVVHD), type of therapy fluid and electrolyte additives ordered, rates of therapy fluid, blood flow, and ultrafiltration (UF), frequency of hemofilter changes, anticoagulant indication and dose, systemic APTT (baseline, lowest and highest daily), and presence of liver dysfunction. Adverse events related to anticoagulation were not assessed.

**Results:** Thirty seven CRRT patients, or 193 CRRT procedure days, were reviewed. Sepsis related diagnoses accounted for 11 of 37 patients (30 percent). The average weight was 90.7 kg (Standard Deviation (SD) 5.1). Duration of CRRT ranged from 1 to 20 days, with the majority of patients (21 of 37) on therapy for 2 to 4 days. Average number of patients per day on CRRT was

1.65 (range 1 to 4). For all CRRT, blood flow rates averaged 189.0 ml/hr (SD 4.4) and UF rates averaged 135 ml/hr (SD 88.7). The usage of CVVH (1586 hours, 47.6 percent) and CVVHD (1747 hours, 52.4 percent) was similar. The mean number of reported filter changes per patient was 2.39 (1.39 SD). Average therapy fluid rates were 1.94 L/hr (SD 0.06), 2.25 L/hr (SD 0.05), and 1.86 L/hr (SD 0.06), respectively for RFP 400, 401, and 402. It is estimated that 406 (31.4 percent), 709 (47.2 percent), and 266 (21 percent) five liter bags of RFP 400, 401, and 402, respectively, were distributed based on average therapy fluid rates and hours of dialysis. Six different customized variations of RFP402 were admixed by pharmacy. Thirteen patients received heparin infusions for: CRRT anticoagulation (11), acute coronary syndrome (ACS) (2), and venous thromboembolism (VTE) (1). One patient had dual indications: initially for CRRT anticoagulation and later for ACS. Seven of the 11 patients on heparin for CRRT anticoagulation (bolus 0 to 5000 units; maintenance 500 units/hr) were able to maintain an APTT below 46 secs during the entire duration of anticoagulation. Mean heparin bolus dose was 48.5 units/kg (range 8 to 80.3 unit/kg). Mean heparin infusion rate was 6.02 units/kg/hr (range 4 to 8.83 units/kg/hr). Two of the 11 patients received heparin doses higher than 500 units/hr. One patient received 600 units/hr (6 units/kg/hr) and maintained an APTT below 46 secs. Another patient received up to 1400 units/hr (16 units/kg/hr) with a maximum APTT of 54 secs. Two additional patients had liver dysfunction. Heparin boluses ranged 0 to 5000 units followed by an infusion of 500 units/hr. Doses were decreased to 300 units/hr (4.3 units/kg/hr) and 400 units/hr (5.4 units/kg/hr) due to APTTs above 46 secs. Three patients received bivalirudin for: CRRT anticoagulation (2) and VTE (1). All were dosed according to the institution's bivalirudin nomogram to treat heparin induced thrombocytopenia (HIT) with an initial dose of 0.06 mg/kg/hr. The patients on bivalirudin for CRRT anticoagulation had APTTs exceeding the upper HIT therapeutic range of 70 secs, well above the desired upper threshold of 1.4 times baseline APTT.

**Conclusion:** Customized CRRT fluid (RFP 402) was ordered 21 percent of the time, which is similar to other published estimates. After the data collection period, a policy was created to limit customized additives to three standardized electrolytes only. The heparin regimen to prevent hemofilter occlusion worked successfully in 78 percent (7 of 9) of patients without liver dysfunction. Bivalirudin starting doses of 0.06 mg/kg/hr to prevent CRRT hemofilter occlusion resulted in suprathreshold APTTs. Future improvements to the institution's CRRT anticoagulation regimens will include a warning that patients with liver impairment may require below normal heparin dosages and the creation of a bivalirudin nomogram to prevent hemofilter occlusion with lower starting doses, APTT goals, and nurse titration instructions.

**5-044**

**Category:** Critical Care

**Title:** Distinguishing comatose from non-comatose improves validity of delirium screening with the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU)

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**Purpose:** The confusion assessment method for the intensive care unit (CAM-ICU) is a validated tool for diagnosing delirium in the intensive care unit (ICU) and yields one of three ratings: positive, negative, and unable to assess (UTA). It was hypothesized that a focused educational campaign would decrease the incidence of inappropriate CAM-ICU UTA ratings, defined as a UTA rating in a non-comatose patient.

**Methods:** This institutional review board approved interventional, quasi-experimental (before-and-after) study was conducted in a surgical ICU at a tertiary academic medical center. Patients admitted or transferred to the surgical ICU from 12/25/2011 through 01/25/2012 were included in the pre-education cohort and from 03/09/2012 through 04/09/2012 were included in the post-education cohort. Nursing reported CAM-ICU ratings and Richmond Agitation Sedation Scale ratings were collected. A nursing educational campaign was conducted from 03/01/12 to 03/07/12. Two-by-two contingency tables analyzed with Chi Squared or Fishers Exact tests were used to compare the proportion of inappropriate UTAs for the pre-education versus post-education.

**Results:** There were 142 admissions or transfers into the SICU during the pre-educational phase reporting 762 CAM-ICU ratings. There were 159 unique admissions or transfers into the SICU during the post-educational phase. Data collection was halted after 860 CAM-ICUs were recorded during the first 112 unique admissions reviewed in the post-education cohort. The nursing in-service was completed by 86% (56 of 65) of surgical ICU nurses and met the a priori goal of 80% attendance. The number of inappropriate UTA ratings decreased significantly in the month immediately following the educational campaign (22% pre-education versus 5% post-education,  $P < 0.001$ ). The a priori goal of a 50% reduction in inappropriate UTA ratings was achieved.

**Conclusion:** A multidisciplinary (pharmacy and nursing) educational campaign clarifying comatose versus non-comatose patient status decreased the proportions of CAM-ICU UTA ratings reported for non-comatose patients. This distinction is a core component of the CAM-ICU assessment and needs to be an area of focus for institutions that plan to implement CAM-ICU screening.

**5-045**

**Category:** Critical Care

**Title:** Nosocomial *Clostridium difficile* infection in ICU patients receiving acid suppressive therapy

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**Purpose:** Recent literature suggests there may be an association between gastric acid suppression and *C. difficile* infection (CDI). It is thought that gastric acidity provides a defense mechanism against ingested bacteria. Many intensive care unit (ICU) patients are at risk for developing stress related gastrointestinal ulcers and therefore need prophylactic therapy, consisting most commonly of a proton pump inhibitor (PPI) or histamine-2 receptor antagonist (H2RA). These medications suppress gastric acid, leading to a higher gastric pH. The primary objective of this study is to determine whether there is an association between acid suppressive therapy and CDI in the ICU. Because both the incidence and severity of CDI are increasing, it is important to identify and understand the risk factors for developing CDI. This study also looked at rates of CDI in patients receiving antibiotics during their ICU admission.

**Methods:** The institutional review board approved this retrospective chart review that encompassed July 1, 2006 to June 30, 2010. The primary outcome, nosocomial *C. difficile* infection, was defined as a newly positive *C. difficile* toxin assay result on or after the third hospital day. Exclusion criteria were patients < 18 years of age, pre-admission use of a PPI or H2RA, pre-admission use of antibiotics within the previous 30 days, history of CDI within the previous 2 months, diagnosis of CDI infection within 3 days of admission, patients who are HIV positive, neutropenic (defined as ANC < 500), or received immunosuppressant or chemotherapeutic medications within the previous 30 days. Patients were stratified into two groups: patients who received acid suppressant therapy (either PPI or H2RA) during their hospital/ICU admission, and patients who did not receive acid suppressant therapy. Patients were also stratified into groups based on what type of antibiotic they received during their hospital/ICU admission. Data is reported as percentages of the total number of patients in the group.

**Results:** During the study period, 771 patients tested positive for *C. Difficile*. Of those, 87 patients (11%) met the inclusion criteria. Only 4 of the 87 patients (5%) did not receive any acid suppressive therapy during their hospital admission. Thirty patients (34%) received an H2RA and 53 patients (61%) received a PPI. The most common indication for stress ulcer prophylaxis in the study patients was mechanical ventilation, with 56 patients (64%). Only 8 patients (9%) did not have an indication for stress ulcer prophylaxis. Eighty six of the 87 included patients received antibiotics during the hospital admission in which they developed CDI. The average

number of days a patient received antibiotics before developing CDI was 12. Most patients received 3 to 4 antibiotics during their hospital admission before they developed CDI.

**Conclusion:** It is difficult to discern whether acid suppression therapy contributes to the development of CDI because almost all patients were receiving multiple antibiotics or had other known risk factors for developing CDI. Our study was limited by the lack of a control group and the small study population.

**5-046**

**Category:** Critical Care

**Title:** Effect of sedation medication and daily awakening on delirium in the mechanically ventilated critically ill patient: a descriptive pilot study

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**Purpose:** Delirium is a disturbance of consciousness associated with negative patient outcomes such as increased time mechanically ventilated, increased intensive care unit (ICU) length of stay, and increased mortality. Sedative medications appear to be the leading iatrogenic cause of delirium. Although daily awakenings are recommended in mechanically ventilated patients, evidence of delirium reduction is lacking. This study will determine if there are differences in delirium, days ventilated, and ICU length of stay between lorazepam, propofol, dexmedetomidine, and fentanyl when patients are concurrently receiving daily awakenings.

**Methods:** This is an institutional review board approved prospective, randomized, open-label, pilot study. Adults admitted to the medical ICU who provided informed consent were enrolled if mechanical ventilation was planned for over 24 hours. Patients were excluded for severe neurological deficits, alcohol dependency, chronic benzodiazepine use, need for neuromuscular blockade, advanced airway modalities, acute myocardial infarction, heart rate less than 50 beats per minute, mean arterial pressure less than 65mmHg, or inability to be randomized within 48 hours of intubation. Subjects were randomized to lorazepam, propofol, dexmedetomidine, or fentanyl for sedation. Each morning subjects underwent a daily waking and were assessed for delirium. The primary outcomes were the incidence of delirium with daily awakenings and between the four treatment arms in the setting of daily awakenings. The secondary outcomes included the difference in days ventilated and ICU length of stay between the four treatment arms. Data are expressed as means and evaluation of primary and secondary outcomes utilized scheffe post-hoc analysis of variance. Comparison of population means employed a one-sample T test.

**Results:** Baseline characteristics were not significantly different between the four treatment arms. The incidence of delirium was significantly higher with propofol compared to dexmedetomidine (78.5 percent versus 5 percent, P-value 0.025). Time ventilated was not significantly different between the four treatment arms (P-value 0.685); nor was the ICU length of stay (P-value 0.646). There was significantly less delirium (-40.5 percent; 95 percent CI, -61.9 percent to -19.1 percent, P-value 0.001), and significantly fewer days in the ICU (-3.11 days; 95 percent CI, -4.77 days to -1.46 days, P-value 0.001) with daily awakenings compared to a historical control without daily awakenings.

**Conclusion:** Dexmedetomidine has a lower incidence of delirium compared to propofol. However, the average times spent mechanically ventilated and in the ICU are equivalent between lorazepam, propofol, dexmedetomidine, and fentanyl in the setting of daily awakenings. The daily awakening process decreased the incidence of delirium and ICU length of stay compared to historical data without daily awakenings.

5-047

**Category:** Critical Care

**Title:** Medication shortages: are alternative agents to facilitate mechanical ventilation safe?

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**Purpose:** Drug supply shortages can potentially compromise patient care. A recent shortage of fentanyl and midazolam, agents that are commonly employed to facilitate mechanical ventilation in the Intensive Care Unit (ICU), prompts the need for alternative agents that produce comparable effects. The purpose of this study is to assess the efficacy of morphine compared to fentanyl and the efficacy of lorazepam compared to midazolam, in ventilated patients.

**Methods:** The study was approved by the Western University of Health Sciences and St. Mary Medical Centers institutional review board with a waiver of informed consent. This is a retrospective review of intubated patients receiving the following drug regimens between October 2011 and February 2012: fentanyl and midazolam (Group 1, Control), fentanyl and lorazepam (Group 2), morphine and midazolam (Group 3). Inclusion criteria consisted of ventilated adult patients ( $\geq 18$  years old) receiving the aforementioned agents. The primary outcome was the achievement of a predetermined sedation goal, and secondary outcome included time to sedation goal. Safety measures included hypotension and self-extubation.

**Results:** 37 patients met the inclusion criteria. The primary outcome of achieving desired Richmond Agitation Sedation Score (RASS) goal occurred in 12 patients (80%), 9 patients (56%) and 4 patients (67%) in groups 1, 2 and 3 respectively. The proportion of patients who achieved the desired RASS goal in each of these groups was shown to be not significantly different ( $p$ -value $>0.05$ ). However, median hours to RASS goal was longer in group 3 versus group 1 (27 vs. 2.5,  $p$ -value 0.02). Hypotension occurred in 11 patients (73%), 13 patients (82%), and 6 patients (100%) in groups 1, 2, and 3 respectively. However, this was not significantly different ( $P$ -value $>0.05$ ). Self-extubation occurred with highest rate (17%) in group 3, although this was not statistically significant.

**Conclusion:** Based on the results, it appears that lorazepam is an effective and safe alternative to midazolam. However, morphine is not a good alternative to fentanyl; of the subset of patients who achieved their RASS goal, it took significantly longer to achieve the sedation goal using morphine than fentanyl. Further studies with larger sample size are needed to validate these results. Of the subset of patients who did not achieve their sedation goal, all of them were over-sedated. Further investigation is warranted to determine the precipitating factors. Although all the patients in the morphine group experienced hypotension, the proportions of patients

experiencing hypotension did not differ significantly between each group. Further studies with larger sample size may be needed to determine morphine safety.

**5-048**

**Category:** Critical Care

**Title:** Continuous intravenous infusion of furosemide: is one electrolyte replacement protocol appropriate for all critically ill patients?

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**Purpose:** Continuous Intravenous (CI) loop diuretic is used for the treatment of hypervolemia associated with conditions such as heart failure, cirrhosis, and kidney insufficiency. Administration of intravenous furosemide by continuous infusion has been used for the treatment of hypervolemia, but this approach has not been validated for critically ill patients at the institution. This study assessed and evaluated the possible adverse drug reactions as well as the appropriate use of intravenous CI of furosemide. An additional objective was to assess if the standard electrolyte replacement protocol will appropriately manage the electrolyte deficiency associated with CI furosemide.

**Methods:** This study is a retrospective medical chart review of 72 patients admitted to the intensive care unit (ICU) from September 2010 to February 2012 in a community teaching hospital. The study included patients receiving CI of furosemide with at least one symptom of hypervolemia (eg. pulmonary congestion, pleural effusion, ascites). Safety endpoints included worsening renal function, hypotension, hypovolemia, and electrolyte disorders.

**Results:** Forty-two patients were evaluated in the study. Eighty-eight percent of the patients developed at least one adverse event during therapy. The most frequent adverse event was electrolyte disturbances (60%), resulting in all patients receiving potassium supplementation and 56% receiving additional magnesium supplementation. Hypotension, hypovolemia, and worsening renal function occurred in 45%, 36%, and 31%, respectively. The recommended supplementation dose based on the institutions electrolyte replacement protocol was not adequate to sufficiently replete the potassium and magnesium requirements. The mean number of hours for follow-up lab draws deviated from the electrolyte protocol.

**Conclusion:** The use of intravenous furosemide by CI was associated with a high occurrence of adverse events. The institutions current electrolyte replacement protocol needs to be reassessed and modified for use in patients receiving furosemide CI. Further studies comparing the efficacy of furosemide CI versus traditional intermittent dosing is recommended.

**5-049**

**Category:** Critical Care

**Title:** Evaluation of spontaneous awakening trials in the medical intensive care unit at a tertiary academic medical center

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**Purpose:** In 2006 our hospital developed and implemented a guideline for the management of pain, agitation, delirium, and neuromuscular blockade in mechanically ventilated (MV) patients. This guideline incorporated recommendations for medication selection, administration techniques, and patient eligibility for a spontaneous awakening trial (SAT). We sought to evaluate the practice of SATs, with a focus on medication administration.

**Methods:** A prospective, observational review of patients mechanically ventilated on continuous intravenous sedation (CIS) in a 20-bed medical intensive care unit from March 25 to April 18, 2012 was approved by our pharmacy peer review committee and institutional review board. There were no exclusion criteria. Patients were deemed eligible for SAT if they were receiving CIS and had no institution-specific contraindications. We collected baseline demographics and endpoints including patient ventilator days, eligibility for SAT, SATs performed, and appropriate administration of medication associated with SATs. Appropriate was defined by the administration of at least 3 boluses of sedative medication before re-initiation of CIS for patients on benzodiazepine-based sedation and an infusion starting dose of less than or equal to 50% of the dose before the SAT for those on either benzodiazepine or propofol-based sedation.

**Results:** Data were collected on 35 patients over 18 ICU days. One hundred seventy-six patient ventilator days [62 via endotracheal tube (ETT) and 114 via tracheostomy (TR)] were evaluated. Thirty-one days (18%) were classified as eligible for SAT and 155 days (82%) as not eligible for SAT (contraindicated or not on CIS). A SAT was performed on 26 of 31 eligible patient ventilator days (90%), with 28 SATs completed overall (23 in ETT group and 5 in TR group). CIS was re-initiated after 14 SATs (50%). Administration of medication associated with SAT was classified as appropriate in 0 out of 5 (0%) patients on midazolam-based sedation and 1 out of 9 patients (11%) on propofol-based sedation.

**Conclusion:** Overall compliance with performance of SAT in eligible MV patients was high in our cohort. Inappropriate sedation boluses and re-initiation of continuous infusions demonstrates the need for continuous quality improvement involving medication administration associated with SATs at our institution.

**5-050**

**Category:** Critical Care

**Title:** Clinical and financial evaluation of a tele-ICU based pharmacy program on stress ulcer prophylaxis (SUP): A pilot project.

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**Purpose:** Critically ill patients (ICU) are susceptible to stress-related gastrointestinal hemorrhage. SUP is typically overused in ICU patients. The objective of this project was to pilot a critical care pharmacist located in a central remote tele-icu center to collaboratively identify, assess and intervene in ICU patients requiring SUP.

**Methods:** A multi-professional workgroup of remote and bedside administrative and clinical leadership developed an SUP initiative in a 38 bed mixed ICU in a 400 bed community hospital. A detailed process of roles and responsibilities, metrics, and education efforts were developed. This pilot project consisted of 2 portions: 1) program verification (1 ICU); 2) interventions for change (5 ICUs). Every evening tele-ICU nurses reviewed each ICU patient (Pt), assessing for presence of SUP and/or major risk factors (intubation, head injury, serious burns, coagulopathy). A data collection form was initiated with the presence of either finding and forwarded to the tele-ICU clinical pharmacist (ePharmacist) who reviewed each patient from the tele-ICU verifying major and > 2 minor risk factors per ASHP guidelines (high risk group) and the presence or absence of SUP. Data for verification was collected from 10/01/10 11/30/10. During a 3 week intervention phase, identification and dissemination of a potential intervention information was identified by the ePharmacist and communicated to each of the 5 individual ICUs clinical pharmacist. All orders, changes and updates were communicated to the bedside and remote nursing staff.

**Results:** During the verification phase, 317 pts were evaluated (216 pts without risk factors and 101 pts at high risk (pts may have more than 1 risk factor). Gender did not differ between the groups but the high risk group was significantly older (59.5+17 vs 66.6+14.8 years p<0.0005). 152 pts (70.4%) without risk factors were given SUP, mostly with a proton pump inhibitor (PPI n=119 76.3%). Intubation was the most common individual high risk factor (n=61 pt) followed by GI bleeding (21 pts), 2 or more minor factors (20 pts), coagulopathy (19 pts) and head trauma (5 pts). Most patients (n=82 65.1%) only had 1 high risk factor present. However, 39 patients had 2 high risk factors and 5 pts had 3 high risk factors. SUP regimens in high risk pts included PPI alone (IV or PO) in 102 pts, H2 Blockers alone (IV or PO) in 9 pts, combination of PPI and H2 blockers in 9 pts, no SUP in 6 pts. Interventions consisted of IV to PO conversion (102 recommendations with 84.3% accepted), D/C SUP (173 recommendations with 52.6% accepted),

pts with multiple agents recommended to discontinue at least 1 agent (8 recommendations with 50% accepted) and addition of SUP (5 recommendations with 40% accepted). The cost of SUP treatment decreased from \$1.06 per adjusted patient day to \$0.77 with a projected annual cost savings of \$78,052.

**Conclusion:** ICU pts without risk factors are frequently given SUP. ICU pts at high risk receiving SUP require optimization of their regimen. Implementation of a remote tele-ICU ePharmacy program in a collaborative SUP initiative is effective and improves identification of over and under treatment as well as streamlines therapy. The improved clinical management is associated with a financial benefit. Identified opportunities for improved guideline adherence would result in greater clinical and financial outcomes.

**5-051**

**Category:** Critical Care

**Title:** Effect of sedation tapering as part of a multi-professional pain, agitation and delirium program on ICU outcomes

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**Purpose:** Institutions continue to struggle with oversedation of patients (pts) treated for agitation. In addition to sedation holiday, current guidelines advocate maintaining a calm, easily arousable patient. However, viable approaches to attain such a state have not been adequately provided. The objective of this project in a 20 bed MICU in a large academic medical center was to assess the value of a sedative taper program (STP) on ICU outcomes.

**Methods:** A critical care pharmacist as part of a remote multi-professional tele-ICU program along with bedside administrative and clinical leadership developed a Pain, Agitation and Delirium (PAD) program. A detailed process of roles and responsibilities, metrics and education efforts were developed. The STP was considered in 2 types of Pts receiving continuous infusion sedative agents: 1) Pts who had at least 3 consecutive RASS scores of 0 or lower without an increase in dose of continuous infusion sedatives; 2) Pts eligible for spontaneous breathing trials. In these patients, the continuous infusion sedative dose was decreased by 10% every 6 hours. A rescue strategy was developed for pts who might become acutely agitated during the process, if necessary. In addition to demographic information, data was collected to determine: pts meeting STP criteria; of those pts, the # where taper was attempted; taper success rate. Outcomes included RASS scores every 2-4 hrs, successful extubations, total ventilator days, APACHE adjusted ICU and hospital length of stay, and total drug use (mg/pt) of lorazepam, midazolam, propofol, dexmedetomidine, morphine, fentanyl and hydromorphone. Data was collected from 5/11/11 to 7/15/11 (baseline period) and 8/29/11 to 3/15/12 (STP period).

**Results:** A total of 594 pts were evaluated (163 baseline, 431 STP) with no significant difference in gender or mean age (55.8% male, 62.0+16.9 yrs baseline vs 51.5% male, 62.6+16.0 yrs STP). There were 435 assessments during the baseline period compared to 1960 assessments (42.0%) during STP. A statistically significant greater % of taper attempts were made (8.3% baseline vs 39.5% STP,  $P < 0.001$ ). Of the patients who met taper criteria, there was no difference in successful tapering (69.4% vs 64.8%) in baseline vs STP pts respectively. A similar % of pts

were SBT eligible (23.1% baseline vs 26.7% STP,  $P>0.05$ ) with a higher % of pts being successfully extubated in STP compared to baseline (51.0% baseline vs 75.5% STP,  $P=0.01$ ). The % pts with an undersedated RASS score was not statistically different (17.4% baseline vs 14.5% STP,  $P>0.05$ ). There was no statistical difference between groups regarding: # ventilator days, adjusted APACHE length of stay, nor overall sedative/analgesic drug administration.

**Conclusion:** We have demonstrated the implementation of a pharmacy program in a collaborative PAD program with an STP contributes to improved ventilation extubations without increased risk of acute agitation in MICU pts. Additional focus on other components of the PAD program will improve additional outcomes as demonstrated by previous investigations.

5-052

**Category:** Drug Information

**Title:** Compliance with location- and service-based formulary restrictions using computerized provider order entry

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**Purpose:** Compliance with location- and service-based formulary restrictions was assessed for medications ordered via computerized provider order entry (CPOE).

**Methods:** All restricted medications that could be ordered via CPOE were reviewed to identify how the restriction criteria were displayed to the provider, whether the restriction was accurate, and if any medications required optimization in the information system or CPOE. Orders placed for medications with formulary restrictions based on location or service were identified using CPOE prescribing data. Medications with at least 30 orders placed during a 3-month period were included in a retrospective cross-sectional analysis to determine compliance with formulary restrictions. The objective was to assess the compliance rate with prescribing restrictions for the included medications and to identify opportunities to improve formulary decision support.

**Results:** There were a total of 114 restricted medications, 77 of which could be ordered via CPOE. Formulary decision support that provided a passive display of the formulary restriction was present for 66 of 77 (86%) medications, and 46 of 77 (60%) had an active display that required the provider to select an appropriate restriction criterion at the point of medication ordering. Eight medications (10%) did not display the restriction anywhere in CPOE, and the majority of medications, 51 of 77 (66%), had at least one opportunity for optimization in the information system. Of the 8 medications included in the cross-sectional analysis, 595 of 716 (83%) orders placed for those medications via CPOE were compliant with formulary restrictions. The compliance rate was highest among medications with correct active restrictions compared with correct passive and incorrect active restrictions (84% vs. 67% vs. 0%, respectively).

**Conclusion:** An analysis of orders placed via CPOE for medications with location- and service-based formulary restrictions demonstrated that orders may be noncompliant with formulary restrictions even if the restriction is displayed at the point of medication ordering. Use of formulary decision support introduces new challenges with regard to knowledge maintenance of the health information system.

5-053

**Category:** Drug Information

**Title:** Key characteristics for the administration of drugs through feeding tubes

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**Purpose:** When administering drugs through a feeding tube, several factors must be taken into account, as osmolarity, pH, sorbitol content, food-drug interactions and absorption place. The aim of this study is to describe these characteristics in the oral liquid dosage forms included in our formulary.

**Methods:** A study about these characteristics (osmolarity, pH, sorbitol content, food-drug interactions and absorption place) was performed in 49 pharmaceutical formulations, containing 46 different drugs. Spanish publications, label information and specific books were reviewed searching this information on April 2012.

**Results:** The formulations osmolarity was unknown in eight cases, it was between 200-700mOsm/kg in three formulations, between 1000-2000mOsm/kg in 13, between 2000-3000mOsm/kg in 13 and above 3000mOsm/kg in 12. The formulations pH was unknown in 31 cases, below 3.5 in three and between 3.5 and 10 in 15. Two out of the 49 formulations contained sorbitol. Regarding to the food-drug interactions, we found no information in nine formulations, in seven this information was referred as not documented and 11 dosage forms could be administered regardless the food. The remaining 23 presented food-drug interactions leading to reduced drug bioavailability in 18 cases. Manufacturer recommended food avoidance in 11 of them but in the remaining 12 no recommendation was given. Focusing on the absorption place, there was no published information for 16 formulations. In other 16, literatures recommendation was not documented. Out of the remaining 17, two had local action, five were absorbed in duodenum, two in jejunum, five in unspecific places of the small bowel and in three cases the information given was gastrointestinal tract.

**Conclusion:** Many formulations bioavailability is reduced due to food-drug interactions and extreme pH difference between bowel and dosage forms. Because of the lack of information about absorption place, drug administration through transpyloric tubes should avoided if possible, and if it is impossible, patient should be monitored for therapeutic failure. Finally, as

almost all formulations have high osmolarities, dilution before administration is recommended to avoid dumping syndrome.

**5-054**

**Category:** Drug Information

**Title:** Cost-effectiveness and implementation of a drug information center in the Bahamas and surrounding Caribbean islands.

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**Purpose:** Currently, no drug information centers exist in the Bahamas or Caribbean Islands. There is a significant strain placed on the Public Hospitals Authority pharmacy budget in the Bahamas. The ability to purchase multiple medications in the same therapeutic class without beneficial cost analysis provided by drug information centers, specifically drug utilization reviews to the Pharmacy and Therapeutics Committee, has depleted the hospitals budget. This project is designed to show how cost-effective it is to have a drug information center in the Bahamas and surrounding Caribbean Islands.

**Methods:** Drug utilization reviews were prepared on four therapeutic classes by the University of New England's College of Pharmacy Dalliery Drug Information Center. These were conducted to demonstrate an improvement of drug therapy, increase the patients quality of care, enhance therapeutic outcomes, reduce inappropriate pharmaceutical expenditures, and finally, reduce overall health care costs. Based on the information provided from the drug utilization reviews to the Pharmacy and Therapeutics committee, the proper adjustments were made to the formulary. The cost savings were documented over a period of three months and presented to hospital administrators.

**Results:** The total cost savings per month from each of the four therapeutic classes were \$13,176, \$1,031, \$12,480, and \$1,914; with an average total savings of \$342,618 for the fiscal year. The hospital administrators believed the data provided by this service was worth the investment of supporting the creation of a drug information center. The clinical and staff pharmacists felt that having access to this type of data provided by a drug information center increased their ability to provide exceptional pharmaceutical care, alleviate cost expenditures, and will provide a much needed resource for where one does not exist.

**Conclusion:** Services provided by a drug information center were helpful with improving patient care, reducing inappropriate pharmaceutical expenditures, and increasing the healthcare teams overall outlook on the profession of pharmacy.

5-055

**Category:** Drug Information

**Title:** Importance of pharmaceutical care regarding the use of ascorbic acid (Vitamin C)

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**Purpose:** Vitamins are a group of unrelated chemical substances, essential to keep metabolism regulation, growth and normal body functions when available in small amounts. Our bodies are not able to synthesize all the needed vitamins, and some of them need to be ingested from an external source, whether through an adequate well-balanced or using dietetic supplements. The purpose of the current research was demonstrating the importance of Pharmaceutical Attention regarding indiscriminate usage of ascorbic acid.

**Methods:** We performed a prospective study through the application of a total of 80 questionnaires to whether health-related areas students (pharmacy, physiotherapy and odontology) at Universidade Santa Ceclia (Santa Cecilia University - UNISANTA) or individuals older than 18 who bought unprescribed ascorbic acid in drugstores located at the neighborhoods of Ponta da Praia and Boqueirao (both located in the city of Santos, state of Sao Paulo, Brazil), during the month of July 2011. The Ethics Committee at UNISANTA approved the study, registered as protocol 15/2011.

**Results:** We obtained 55% of the sample were female respondents; 50% of the total were between the ages of 18 and 35, 37% were older than 50 years and 13% between 36 and 50 years old. 24% of the studied population used ascorbic acid as dietetic supplement, 19% as a symptomatic for cold and flu and 13% intending to improve immunity. Among those who took at least one more concomitant continuous medicine, we found 27% who used anti-hypertensive drugs, 20% used contraceptive drugs and 18% took antidiabetic drugs. Regarding the doses, 48% took daily doses of 500mg, 47% used 1000mg and 5% took 2000mg/day. 51% of the evaluated sample used ascorbic acid as a continuous drug, and 24% used it for 30 days periods.

**Conclusion:** The obtained data suggest how important it is to establish an adequate policy of drug dispensation, placing the pharmacist in a central role of education, health promotion and rational use of medications. An example is the adequate orientation and close follow-up for diabetic patients, in which high serum levels of ascorbic acid can lead to severe interference when dosing seric glucose, as well as those patients with a medical history of renal lithiasis, who can be prone to develop oxalate calculi when exposed to high ascorbic acid blood levels.

5-056

**Category:** Drug-Use Evaluation

**Title:** Evaluation of pioglitazone use in a rural VA healthcare system

**Primary Author:** Kelly Moran, Clinical Coordinator/Residency Program Director, VA Black Hills Health Care System, 500 North 5th Street, Hot Springs, SD, 57747; Email: kelly.moran@va.gov

**Purpose:** Pioglitazone, a thiazolidinedione, is a commonly prescribed antidiabetic medication used in type 2 diabetes mellitus that has been available in the United States for over a decade. In June 2011, the Food and Drug Administration (FDA) changed the labeling on pioglitazone to include a new warning and precaution of increased bladder cancer in patients taking the medication for over one year. At that time, the FDA recommended to health care providers not to prescribe pioglitazone in patients with active bladder cancer and use with caution in patients with a history of bladder cancer. The purpose of this medication use evaluation was to ensure the safe and appropriate use of pioglitazone within our healthcare system.

**Methods:** The Pharmacy and Therapeutics Committee approved this retrospective chart review. The Veterans Affairs Pharmacy Benefit Management Services (VA PBM) Pioglitazone Criteria for Use was used to determine the appropriateness of pioglitazone use. As part of the criteria for use, patients that did not have a greater than one percent drop in their hemoglobin A1C after six months of therapy were not considered appropriate candidates for pioglitazone. Patients were included in the chart review if they had an active prescription for pioglitazone in February 2012. The computerized medical record was reviewed for the following data: age; gender; pioglitazone start date, dose, frequency; pioglitazone current dose, frequency; use of other antidiabetic medications before and after initiation of pioglitazone; history of heart failure and bladder cancer; hemoglobin A1C at baseline, 3-6 months after initiation and current A1C.

**Results:** One hundred twenty two patients had an active prescription for pioglitazone in February 2012. Of the new starts on pioglitazone, 90 percent met the VA PBM pioglitazone initiation criteria for use. However, 25 percent did not meet the continuation criteria of a meaningful improvement in glycemic control. Two-thirds of patients on pioglitazone did not reach their hemoglobin A1C goal and over half of those not meeting goal were not on the maximum dose of pioglitazone. Two patients had a diagnosis of heart failure class I or II and one patient had a past history of bladder cancer.

**Conclusion:** Providers and pharmacists were following the VA PBM criteria for use when initiating pioglitazone therapy. Despite following the initial criteria, pioglitazone use within the healthcare system can be improved. Providers and pharmacists were educated on maximizing pioglitazone dose and discontinuing pioglitazone if no meaningful improvement in glycemic control is seen. Pioglitazone was discontinued in the one patient with a history of bladder cancer.

5-057

**Category:** Drug-Use Evaluation

**Title:** Drug use evaluation of sitagliptin in patients with renal impairment

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**Purpose:** Since diabetic patients have been increasing, use of DPP-IV inhibitor is in growth due to low risk of side effects, such as hypoglycemia and weight gain. Sitagliptin(SITA), one of DPP-IV inhibitors has only one kind of dosage, 100mg on the market, which needs dose adjustment in renal impairment(RI) though. We planned to estimate current condition of dose adjustment of SITA in RI to apply in therapeutic intervention by pharmacists.

**Methods:** Construction of the study sample began with the selection of outpatients in our hospital who were prescribed SITA alone or four types of combination drugs from January 2009 to December 2010. Serum creatinine(SCr) tests and frequency of all patients included in the study sample were reviewed through electronic medical records (EMR) charts, in addition, dose adjustment of SITA in moderate or severe RI and adverse events were estimated. Index of dose reduction by renal function was based on KFDA guidelines and adverse event was evaluated with Korean algorithm V2.0 using the statistical analyses of chi-square test, Fishers exact test and Wilcoxon rank sum test.

**Results:** Among the patients prescribed SITA(2497 patients), the ratio of prescribing SCr test on the day of prescribing SITA was 58.3% in division of endocrinology and 62.4% in division of nephrology, respectively. In case of moderate RI or severe RI following the result of SCr test, dose reduction group included 76 cases of moderate RI(35.3%) while non-dose reduction group included 13 cases of severe RI(100%) and 139 cases of moderate RI(64.7%). 13 cases showed a causal relationship possibly with adverse events, that non-dose reduction group accounted for 9 cases(69.2%) of them. Adverse events appeared as diarrhea, abdominal pain/nausea, upper respiratory tract infection/pharyngitis and headache in both groups, but hypoglycemia(2 cases) occurred only in non-dose reduction group.

**Conclusion:** As the result, frequency of SCr test was significantly higher in division of endocrinology and nephrology compared to other departments. SITA dose had not been reduced in more than 60% of patients with moderate RI, which increased the incidence of adverse reaction. Additionally, importance of dose adjustment was emerged since hypoglycemia had only occurred in non-dose reduction group. Therefore, medical intervention and providing information from pharmacist should be activated when SITA is prescribed in RI patients.

5-058

**Category:** Drug-Use Evaluation

**Title:** Use of Cabazitaxel for Metastatic Prostate Cancer in Clinical Practice

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**Purpose:** Cabazitaxel has been recently approved by Spanish Medicines Agency for the treatment of patients with metastatic castration-resistant prostate cancer with progressive disease after docetaxel-based treatment. This study describes the use of cabazitaxel in clinical practice compared with the pivotal essay, TROPIC.

**Methods:** we undertook a retrospective review from March 2011 to March 2012 of all patients with metastatic castration-resistant prostate cancer (label indication) that were treated with cabazitaxel 25 mg/m<sup>2</sup> every 3 weeks in combination with oral prednisone. We review the following variables: age, ECOG, haematological, hepatic, renal and cardiac function at the beginning of treatment, time from last docetaxel dose to disease progression, number of cabazitaxel cycles and time to tumor progression.

**Results:** a total of five patients received cabazitaxel during the study period, the median age was 67 years (59-73), all patients had ECOG < 2 and adequate haematological, hepatic, renal and cardiac function. There were differences between the time from last docetaxel dose to disease progression: more than 6 months in two patients and less than 6 months in three, the median time from last docetaxel dose to disease progression for cabazitaxel group in the TROPIC trial was 0,7 months (0-2,9). Patients treated with cabazitaxel in the main study received a median of 6 treatment cycles, the median in our patients was 5 cycles (4-10). The median time to tumour progression (months) in our patients was 4 months (3-13,5) compared with 8,8 months published in the pivotal study. Only one patient obtained radiological and clinical response during 13,5 months after 10 cycles of cabazitaxel, with stable disease after 5 months (the time from last docetaxel dose in this patient was more than 6 months). The other four patients had progression disease before the 5 cycle of cabazitaxel.

**Conclusion:** the use of cabazitaxel in clinical practice in patients with the same inclusion criteria that in the main study submitted do not offer, for the moment, the same results in progression-free survival and median time to tumour progression. Patients with the same clinical inclusion criteria as the main study TROPIC obtained a median time to tumor progression shorter than 8,8 months published in the study.

5-059

**Category:** Drug-Use Evaluation

**Title:** Acyclovir and hyponatremia: a case report

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**Purpose:** A 61-year-old male attended the emergency room with decreased level of consciousness, repetitive language and memory loss. Clinical history included type II diabetes and hypertension. Domiciliary treatment consisted of metformin 850 mg every 24 h p.o. and indapamide 2.5 mg every 24 h p.o. Laboratory tests disclosed high glycaemia (198 mg/dL), increased C reactive protein (7.4 mg/dL) and normal renal function. The computed tomography did not show any sign of acute pathology. Acyclovir 800 mg every 8 h i.v. was started on admission due to suspicion of a viral encephalitis. The rest of medication prescribed was enoxaparin 40 mg every 24 h s.c., amlodipine 10 mg every 24 h p.o., rapid-acting insulin s.c. based on blood glucose, metoclopramide 10 mg every 8 h i.v. if nausea or vomiting and acetaminophen 1,000 mg every 24 h i.v. in case of fever or pain. The second day of hospitalization he was prescribed citalopram 10 mg every 24 h p.o. due to depressive symptoms. Blood analysis of the tenth day displayed hyponatremia (123 mmol/L) that was at first explained by the high intake of water the patient started to present three days before, so water restriction was decided. After the nuclear magnetic resonance on day 14 identified an ictus, treatment with acyclovir was withdrawn. Three days after withdrawal, plasmatic sodium levels began to increase (128 mmol/L) and returned to normal six days after (133 mmol/L). Although hyponatremia is not mentioned in the summary of product characteristics of acyclovir, two reports in literature suggest that this drug could be a causative agent of hyponatremia (1,2). Hypothyroidism and Addison's disease were excluded as other possible causes of hyponatremia since thyroid function and adrenal steroid hormones were normal. Citalopram was also excluded, since treatment with this drug continued when plasmatic sodium levels started to return to normal. The potomania cannot be ruled out as another possible cause of hyponatremia, but the rapid increase of plasmatic levels after discontinuation of acyclovir is remarkable. We believe there is a relationship between acyclovir and hyponatremia. Application of the Karch and Lasagna algorithm to assess the causality of the reaction induced by acyclovir revealed the relationship to be possible. 1. Kageyama Y, Nakamura M, Sato A, Sato M, Nakayama S, Komatsuzaki O, et al. Syndrome of inappropriate secretion of antidiuretic hormone (SIADH) associated with Ramsay Hunt syndrome: report of a case and review of the literature. *Jpn J Med.* 1989 Mar-Apr;28(2):219-22. 2. Kucukardali Y, Solmazgul E, Terekeci H, Oncul O, Turhan V.

Herpes zoster ophthalmicus and syndrome of inappropriate antidiuretic hormone secretion.  
Intern Med. 2008;47(5):463-5.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

**5-060**

**Category:** Drug-Use Evaluation

**Title:** Anti-angiogenic drugs and cardiogenic shock: a case report

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**Purpose:** A 56-year-old male attended the emergency room with respiratory failure, deteriorated general status, fatigue and diarrhea. His clinical history included a liver transplant because of alcoholic cirrhosis, which developed to hepatocellular carcinoma. The patient also suffered from hypertension and hypertriglyceridemia. Initial immunosuppression consisted of corticosteroids, tacrolimus and mycophenolate mofetil. Examination of the explant revealed vascular invasion, which pointed to a high risk of recurrence of hepatocellular carcinoma; consequently, tacrolimus was replaced with everolimus (1.5 mg every 12 h p.o.). However, the patient finally presented recurrence of the carcinoma with peritoneal implants, and treatment with sorafenib was started (400 mg every 12 h p.o.). The rest of his domiciliary treatment was omeprazole p.o. (40 mg every 24 h), enoxaparin s.c. (40 mg every 24 h), furosemide p.o. (40 mg every 24 h), carvedilol p.o. (3.125 mg every 12 h), captopril p.o. (12.5 mg every 8 h), atorvastatin p.o. (80 mg every 24 h), lorazepam p.o. (1 mg every 24 h) and acetaminophen p.o. (500 mg every 8 h in case of pain). He was admitted to the gastroenterology department and, after withdrawal of sorafenib, the patient improved clinically. However, six days later he was admitted to the intensive care unit with acute respiratory failure and metabolic acidosis. Echocardiography revealed a severely dilated left ventricle and severe global hypokinesia with a substantially depressed ejection fraction (left ventricle ejection fraction < 10%) compared to a previous normal echocardiography carried out before transplant. The final diagnosis was cardiogenic shock. Although cardiogenic shock is not mentioned in the summaries of product characteristics of sorafenib or everolimus, there are reports of a relationship between cardiotoxicity and anti-angiogenic therapy that inhibits the proliferation of vascular smooth muscle cells, as is the case with these drugs. Increasing use of targeted anti-cancer agents that inhibit tyrosine kinase signaling has improved the survival of cancer patients; however, cardiotoxicity is becoming an important issue. All the reported cardiac events are partially reversible and respond to medical management, thus making early recognition a crucial factor. We believe there is a relationship between the combination of sorafenib and everolimus with cardiogenic shock. Given the limited experience with this combination of drugs, it is essential that health professionals undertake adequate pharmacological follow-up of patients treated with both drugs. Application of the Karch and Lasagna algorithm to assess the causality of the reaction induced by the combination of sorafenib and everolimus revealed the relationship to be probable.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

**5-061**

**Category:** Drug-Use Evaluation

**Title:** Risk assessment associated to natalizumab therapy

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**Purpose:** Progressive multifocal leukoencephalopathy (PML) is an opportunistic viral infection of the central nervous system (CNS), which usually leads to death or severe disability. In patients receiving natalizumab therapy, some independent risk factors are associated with an increased risk of PML: duration of treatment (especially beyond 2 years), the use of immunosuppressive agents (eg: mitoxantrone) before receiving the drug and the presence of anti-JCV antibodies. The purpose of this study is to calculate the estimated risk of developing PML in patients receiving treatment with Natalizumab.

**Methods:** Literature search was performed to determine the relative risk of developing PML for the different factors in analysis. Patients with multiple sclerosis under Natalizumab therapy in June 2011 were evaluated regarding the risk of developing PML.

**Results:** This evaluation included 13 patients with multiple sclerosis under Natalizumab therapy, 10 of them were females (76.9%), with a mean age of 37.0 4.5 years [18-56 years]. Five patients (38.5%) had therapy with Natalizumab for over two years, three (23.1%) made immunosuppressive agents prior to Natalizumab and seven (53.8%) had a positive result for anti-JCV. Regarding PML risk, 4 patients have no risk factors (PML risk=0.19), 5 patients have only one risk factor (PML risk=1,37) , 2 patients accumulate 2 risk factors (PML risk=4,3) and 2 patients have all three risk factors in analysis (PML risk=7,8). The presence of the 3 risk factors, in MS patients treated with Natalizumab, increases 41 times the risk of PML when compared with the absence of risk factors.

**Conclusion:** This analysis helped determine which patients have an increased risk in developing PML, allowing to the Neurology department to assess more objectively the risk-benefit of Natalizumab therapy.

**5-062**

**Category:** Drug-Use Evaluation

**Title:** Evaluation of a clinical pharmacist intervention to individualize pancreatic enzyme therapy to the lowest effective dose

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**Purpose:** As of 2010, pancreatic enzyme products are required to meet the Food and Drug Administration safety and efficacy standards, where previously these medications were unregulated. Studies suggest patients treated with higher doses of enzyme therapy may equally benefit from lower doses. The purpose of this study was to evaluate the outcomes of a clinical pharmacist intervention to individualize pancreatic enzyme therapy to the lowest effective dose for a group of veteran patients prescribed high-dose pancreatic enzyme supplementation.

**Methods:** This study was performed as a retrospective medical record review. The study population included patients receiving pancreatic enzyme therapy at doses of greater than or equal to 60,000 lipase units per day and who received a clinical pharmacist intervention between September 1, 2011 and April 1, 2012 at the Ralph H. Johnson VA Medical Center. The primary aim of this study was to determine the difference in the mean daily dosage for this group of patients before and after intervention. Efficacy was evaluated by comparing the number of bowel movements per day, patient reported stool consistency, and patient weight before and after intervention. Tolerability was determined by evaluating daily pill burden and the patients subjective perception of symptoms before and after pharmacist intervention. Additionally, annual cost avoidance was evaluated by comparing the study groups mean baseline cost of therapy with mean cost after pharmacist intervention.

**Results:** The clinical pharmacist intervention included 45 patients receiving high-dose enzyme therapy: 62 percent (n equals 28) were able to discontinue therapy completely, 22 percent (n equals 10) had a dose reduction, and 16 percent (n equals 7) remained on their original dose. There was a statistically significant decrease in the mean daily dose of 105,444 lipase units to 79,111 lipase units per day (p equals 0.0001) for the entire group (n equals 45) and 117,647 lipase units to 47,941 lipase units per day (p equals 0.0004) for the patients who remained on therapy after the pharmacist intervention (n equals 17). No statistical difference was determined for efficacy measures: stool frequency, stool consistency, and patient weight. Pill burden was decreased from 6.5 to 2.1 capsules per day (p equals 0.0001) for the entire group and 7.9 to 5.5 capsules per day (p equals 0.0054) for the patients who remained on therapy after intervention. For the entire group, a mean annual cost avoidance of 2,053 US dollars per patient was achieved; subgroup analysis based on refill history of compliant patients (n equals 22) showed a mean annual cost avoidance of 1,845 US dollars per patient.

**Conclusion:** Clinical pharmacist intervention for patients receiving high-dose pancreatic enzyme therapy resulted in a statistically significant reduction in mean daily dose, daily pill burden, and potential for significant annual cost savings. Applying these results, healthcare providers should consider reassessing the need for prescribing initial pancreatic enzyme supplementation and/or the continuation of therapy, as well as individualizing doses specific for patient symptoms. These measures may result in clinically important prevention of unnecessary prescribing, improved daily pill management for patients, and significant savings in health care expenditures.

**5-063**

**Category:** Drug-Use Evaluation

**Title:** Clinical and economic evaluation of roflumilast for severe COPD patients with implications for the Veterans Administration budget

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**Purpose:** Chronic obstructive pulmonary disease (COPD) is a common condition affecting over 1.8 million patients in the Veterans Administration (VA) healthcare system, costing over \$7.5 billion annually including costs of therapy and hospitalization resulting from severe exacerbations. Roflumilast (Daliresp) is a novel, oral phosphodiesterase 4 inhibitor shown to reduce frequency and severity of moderate-severe COPD exacerbations. This study was conducted in order to assess the clinical and economic evidence as well as the impact and viability of widespread use of roflumilast on the VA budget.

**Methods:** A systematic literature review was conducted on roflumilast along with a budget impact analysis to evaluate the costs of adding roflumilast as first-line therapy in the VA. The costs included the FSS price of the drug combinations, as well as predicted hospitalization costs due to COPD exacerbations. The VA recommends COPD treatment with a LABA (fomoterol) or a LAMA (tiotropium) plus a short acting bronchodilator, typically albuterol, as a rescue medication. Patients who had one or more contraindications to roflumilast, such as psychiatric conditions or Child Pough score of B or C, were considered ineligible for add on therapy in our evaluation. Since many veterans suffer from PTSD and other psychiatric conditions (and hepatic impairment is common in this population), the patient population eligible for such therapy was narrowed.

**Results:** Multiple clinical trials have demonstrated that roflumilast, alone or in combination with inhaled COPD treatments, can reduce exacerbations with fewer adverse effects, compared to traditional therapy alone. However, the studies were limited by non-diverse populations that consisted of mostly white men and excluded those with low health literacy. Additionally, the studies conflicted in their results concerning improvements in quality of life with roflumilast. While roflumilast has potential as an agent for COPD, current clinical evidence does not provide consensus on the reduction in the rate of exacerbations with roflumilast or the improvements in patient reported quality of life, two vital pieces of data for evaluating the role of roflumilast in COPD therapy. There were two studies that evaluated the economic considerations of roflumilast for COPD and only one in the the United States context. Comparators in both economic analyses were inadequate to reflect current treatment options. Both studies suffered from limitations that prevent the generalizability of their results based on limited patient populations, lack of appropriate comparators, and unclear and variable data as to the efficacy of roflumilast at

reducing exacerbations and associated costs. For the budget impact analysis, we assumed that approximately 45% of 908,000 COPD treated patients would be eligible to receive roflumilast. This became our best case scenario to maximize the potential benefit of the drug. This in turn, decreased the average hospitalization costs in patients receiving roflumilast therapy. However, the decreased cost of hospitalization does not offset the cost of adding therapy (FSS cost of \$170.76 per person, per month). We also opted to evaluate the budget impact with a more conservative number of eligible patients willing to switch, 5% (worst case). This increased overall cost was apparent in both best and worst case scenarios for all three treatment groups, with the baseline treatments alone being the most cost effective, followed by the addition of roflumilast in 5% of patients, and lastly, the addition of roflumilast in 45% of the VA population currently on COPD therapy. The least expensive scenario was fomoterol plus albuterol base case which was \$7,528,772,800 in total costs per year for 908,000 patients. The most expensive scenario was when roflumilast was added to the fomoterol plus albuterol plus fluticasone 110mg in 45% of patients on COPD therapy, which totaled \$8.8 billion per year.

**Conclusion:** Roflumilast demonstrates significant potential for cost savings due to a reduction in exacerbations, and potentially increased ease of administration. It provides a unique mechanism of action for the treatment of COPD. Due to unclear efficacy and the small number of eligible VA patients, roflumilast does not appear to be the best option from an economic perspective for adjunct therapy for COPD in addition to standard regimens, such as a LABA, LAMA, or ICS based on the current analysis.

**5-064**

**Category:** Drug-Use Evaluation

**Title:** Retrospective study of the use of ipilimumab in a french University Hospital

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**Purpose:** The incidence of melanoma has increased steadily in recent years, with poor prognosis due to the often late diagnosis of the disease. At the metastatic phase, the median life survival is less than one year. A new treatment, ipilimumab, has been recently developed. It inhibits the CTLA4 receptor of the T-lymphocytes inducing an immune response against the tumor. Since 2010, ipilimumab received an authorization for a compassionate use program in France allowed for refractory patients with a melanoma in phase 3 or 4 after at least a conventional treatment.

**Methods:** The objective of our retrospective study is to evaluate this drugs use in our hospital on analyzing efficiency and tolerance data on medical records. A database was created, including: - demographic and antecedent data - treatment data.

**Results:** Since 2010, 16 patients of dermatology ward received this treatment (sex ratio 1/1, median age: 62 years [39 ; 87]). Six of them received it after a previous treatment course of chemotherapy and 10 after two courses. Patients were treated after an average time of 3.1 years. They were all treated in accordance with the regimen edited by French healthcare agency (4 courses of 3 mg/kg/21 days for 1 cycle). Eight patients stopped it prematurely during the first cycle (side effects: n = 4; progression of the disease: n = 4) and only 8 patients received the full 4 courses treatment. Two of them died after an average period of 9.3 months, one with a partial remission, and 5 patients were switched to another course of chemotherapy. One patient was reintroduced. Six patients had side effects of grade 3 or 4 (3 with diarrhea, 2 with pancreatitis and 1 with thrombocytopenia) recovered after symptomatic treatment and corticotherapy.

**Conclusion:** In comparison with published studies, survival rate is similar but we observed more side effects. French healthcare authorities have licensed in September 2011 this new very expansive molecule. A confirmation of its efficacy and tolerance was ordered by the agency in comparison with new targeted therapies (reserved for patients with BRAF mutation) in the melanoma strategy treatment.

**5-065**

**Category:** Drug-Use Evaluation

**Title:** Outpatient pharmacist academic detailing reduces prescribing of non-preferred drugs and improves quality and cost

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**Purpose:** Prescribing of non-preferred drugs contributes to increased costs and compromises quality. Targets for quality and cost were not being achieved despite the existing pharmacist-clinician relationship and prescribing decision support. Pharmacist-clinician academic detailing was integrated into the role of the outpatient pharmacist to reduce the use of non-preferred drugs and improve quality.

**Methods:** Medical group and pharmacy leadership established the goals, timeline and resources necessary for pharmacists to engage primary care clinicians in face-to-face 10-minute academic detailing sessions. Pharmacy supervisors identified pharmacists for detailing, gained medical office leadership support, coordinated with schedulers to set up meeting time with clinicians, scheduled pharmacists to attend monthly training webinars and to meet with clinicians. Formulary and drug use management pharmacists identified topics for detailing, developed and presented monthly pharmacist training webinars and detailing materials. Pharmacy analysts developed corresponding clinician prescribing reports. In addition to attending monthly training webinars, pharmacists prepared for the detailing sessions by reviewing clinician prescribing reports for opportunity and formulating a tailored message for each clinician. Pharmacists then met with each clinician to deliver information about non-preferred drugs and preferred alternatives, review prescribing reports, offer support for drug conversions, and build rapport.

**Results:** In 2012, 70 pharmacists have engaged over 350 clinicians in adult primary care and pediatrics in more than 800 total 10-minute academic detailing sessions. The use of targeted drugs has decreased as follows: Lantus 2 percent, Galantamine 27 percent, Advair 20 percent, Cymbalta 4 percent and Abilify 14 percent. The decrease in prescribing led to the following decrease in cost: Lantus 1.8 percent, Galantamine 8.1 percent, Advair 8.1 percent, Cymbalta 4.1 percent and Abilify 8.1 percent. Also, the total dispenses of skeletal muscle relaxants in patients over age 64, a HEDIS quality measure, decreased by 17 percent.

**Conclusion:** Implementation of a structured, integrated academic detailing program using outpatient pharmacists to detail primary care clinicians resulted in reduced prescribing of non-preferred drugs, reduced drug costs, and improvements in quality measures.

**5-066**

**Category:** Drug-Use Evaluation

**Title:** Prescription of fractional doses of solid oral drugs in hospital: a qualitative and quantitative description

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**Purpose:** The search of the best care for patients in the hospital requires the best medication dose adjustment possible depending on each patient and his pathology. Therefore many solid oral forms are currently prescribed in fractional doses. The objective of this study is to evaluate the frequency of divided doses prescribed in the hospital a given day. Distinction between off-label prescriptions (potentially requiring a magistral preparation) and those comply with the Summary of Product Characteristics (SmPC) was made.

**Methods:** This survey was conducted a given day, analyzing almost all prescriptions in the hospital. Number of total drugs prescribed and number of dry oral forms were determined per patient, as well as number, name and dosage of each drug prescribed in fractional doses. For these last drugs, breakability or availability of same drug in another pharmaceutical form were assessed.

**Results:** Prescriptions of 701 patients hospitalized in 28 different services were analyzed. Among the 6101 counted drugs, 70% (4276) are solid oral forms. There are 254 prescriptions (74 pharmaceutical specialties) in fractions of dose were identified, representing almost 6% of all dry oral form prescribed. Cardiology (25.6% of the 254 prescriptions), pneumology (12.2%), internal medicine (11.8%) and nephrology (11%), are the services which have prescribed the more divided doses. The therapeutic classes most frequently found are anxiolytics (31.2%), vitamin K antagonists (15.9%), diuretics (9.5%) and beta-blockers (9.1%). This represents 323 divided doses: 18.6% (60) refers to inadequate prescription (dosing form available, typing errors ...) whereas 81.4% (263) of these divided doses are intentional. The number of drugs which can be effectively scored is 59 (representing 233 prescriptions) but 15 drugs can not. Among these 15 unscored drugs, 4 have a alternative pharmaceutical form existing (drinkable form, or breakable generic). It remains 11 drugs which can not be splitted, have no alternative form. These last are often prescribed off-label, and therefore should be approved by a senior and documented.

**Conclusion:** Given the existence of a real risk associated with repeated administration of approximate and variable doses, pharmaceutical recommendations are essential: acknowledge of drug breakability, alternative form available, monitoring of plasma concentrations if possible. If

a fractional dose is absolutely needed, the preparation of divided doses from unscored tablet must remain a pharmaceutical act.

5-067

**Category:** Drug-Use Evaluation

**Title:** Evaluation of initial vancomycin trough concentrations in obese patients receiving vancomycin

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**Purpose:** Guidelines suggest that vancomycin should be dosed based on total body weight; however, limited data is available to guide dosing in obese patients. Given the increasing prevalence of morbid obesity in the United States, this evaluation was completed to determine initial target trough attainment in obese patients receiving vancomycin based on a hospital dosing nomogram.

**Methods:** A new pharmacy vancomycin dosing protocol using total body weight was implemented in 2011. This protocol has a maximum per dose cutoff of 2500 mg for a loading dose and 2000 mg for a maintenance dose. To assess initial trough concentration attainment in obese patients, a retrospective review was conducted over an eight month period following protocol implementation. Patients were excluded if they had a body mass index (BMI) less than 30 mg/kg<sup>2</sup> or no evaluable trough concentration. The primary outcome measure was the percentage of patients with an initial target trough concentration within the recommended range according to diagnosis. A comparative group was utilized to assess target trough attainment in non-obese patients.

**Results:** Forty six obese patients received at least one dose of vancomycin. Twenty six patients were excluded because they either had no evaluable vancomycin trough concentration or the dosing nomogram was not followed. Twenty evaluable patients were included in the analysis. The mean patient weight was 136 kg (range 102 to 209 kg) and BMI 44.3 mg/kg<sup>2</sup> (range 32.2 to 86.9 mg/kg<sup>2</sup>). Of the 20 evaluable patients 5 (28%) had an initial target trough level within the recommended range according to indication. Of the remaining 15 patients, 9 (45%) patients had an initial trough concentration that exceeded the target trough range and 6 (30%) patients had a concentration below the recommended range. The mean maintenance dose was 24.7 mg/kg/day.

**Conclusion:** The hospital dosing nomogram resulted in higher than target initial vancomycin levels in 45% of obese patients. The results further support that a maximum mg/kg dose or daily maximum dose should be utilized for dosing vancomycin in obese patients. Higher doses may result in elevated trough concentrations and lead to increased risk of toxicity. No standard maximum mg/kg dose for obese patients exists.

**5-068**

**Category:** Drug-Use Evaluation

**Title:** An evaluation of pharmacy and nursing compliance to the weight based heparin protocol in a community teaching hospital

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**Purpose:** Unfractionated heparin (UFH) remains an important parenteral anticoagulant for the treatment of several thrombotic disorders. Studies have demonstrated improved patient outcomes when targeted therapeutic ranges of activated partial thromboplastin time (aPTT) are achieved within 24 hours of therapy initiation. These therapeutic ranges are best achieved when weight-based heparin protocols are utilized. At our institution, heparin dosing and monitoring involves multidisciplinary collaboration between prescribers, nurses and pharmacists. There are two nomograms available; a low dose nomogram for patients with acute coronary syndrome (ACS) with an aPTT target range of 50 to 70 seconds and a high dose nomogram for patients for other indications including venous thromboembolism, atrial fibrillation or flutter with an aPTT target range of 54 to 83 seconds. A paper color-coded copy of each nomogram is available in the pharmacy. The prescriber initiates the process by ordering a weight-based heparin protocol and defining the indication for therapy. The pharmacist calculates the initial loading dose and maintenance dose based on the patients weight using the appropriate form. For obese patients a dosing weight (DWT) is calculated using the following formula: ideal body weight (IBW) plus 0.4 (difference between the actual body weight (ABW) and the IBW). When the patients dosing weight falls between two points for example 70 and 75 kilograms, the pharmacist will round down to the closest 5 kilogram. The pharmacist is responsible for verifying that baseline laboratory tests have been ordered prior to entering the heparin order into the computer. Our pharmacy utilizes a standard heparin concentration of 25,000 units per 500 milliliters, 5 percent dextrose solution (D5W). The protocol requires that two nurses verify the pharmacist calculation, as well as the infusion pump setting prior to initiation of the heparin infusion. The nurse is also responsible for verifying the availability of baseline laboratory tests prior to starting the infusion, and for obtaining the aPTT 6-8 hours after any bolus dose, dosage adjustments, and daily once the aPTT is in therapeutic range. The nurse modifies the patients heparin doses and infusion rates based on the aPTT, documents any signs and symptoms of bleeding and other adverse events. On a daily basis, the pharmacist reviews the patients laboratory values and consults with the nurse to assure appropriate dosage adjustments and side effects monitoring. We conducted this medication use evaluation to determine the pharmacist and nursing compliance with the weight-based protocol and to determine the rate at which our patients achieve therapeutic aPTT targets using our current weight-based heparin protocol.

**Methods:** A computer generated list of all patients who were prescribed UFH 25,000 units per 500 milliliters D5W at our 240 bed community teaching hospital between May 1, 2011 and May 31, 2012, were obtained. A comprehensive review of the patients electronic medical records was conducted. Medical records were available through Meditech, Nursing electronic medication administration record and ChartMaxx (an electronically available scanned copy of the patients paper medical chart). Patients were excluded from the study if they received heparin infusions for less than 24 hours, or their heparin infusions were prescribed by vascular surgeons with targeted therapeutic ranges outside those recommended by our protocol. Pharmacy compliance with the protocol was determined by evaluating the accuracy of pharmacy calculation of the bolus and maintenance infusion doses, and the use of the appropriate nomogram form based on the prescribers indicated patient diagnosis. Nursing compliance with the protocol was determined based the nurses ability to: adhere to the correctly calculated heparin dose by the pharmacist; obtain all aPTT levels between 6-8 hours following any bolus or dosage adjustments; make appropriate dosage adjustments based on aPTT levels; and document on the dosing form that 2 nurses reviewed and signed off on dosage calculations and adjustments. Data collected include the following: age, gender, height, ABW, calculated IBW and DWT, Pharmacy bolus and maintenance doses calculated and administered, baseline laboratory tests including complete blood counts and aPTT, serum creatinine. APTT ranges were evaluated at 3 points within 24 hours post initiation of therapy. The first aPTT at 6-8 hour post therapy initiation, the second aPTT at 6-8 hours post dosage adjustment (if applicable) and third 6-8 hour post dosage adjustment aPTT (if applicable). Additionally, the number of patients who achieved therapeutic aPTT at each interval as well as within 24 hours and the availability of daily aPTT after therapeutic level were recorded. We also recorded any documented adverse events from heparin therapy. The data was collected and analyzed using the Microsoft Excel Spreadsheet program.

**Results:** A total of 88 patients met the inclusion criteria for this study. Sixteen patients received heparin for acute coronary syndrome while 72 patients were treated for pulmonary embolism, deep venous thrombosis, atrial fibrillation or flutter. The majority (86 percent) of the patients were African American. 12.5 percent were Caucasian, and 1.5 percent were Hispanic. Fifty-six (64 percent) of the patients were males. The mean age of the patients in the study was 63.1 years (range 25 to 98), the mean ABW was 87.3 kilograms (range 28 to 225), mean height was 73 inches (range 58 to 78) and mean DWT was 73.3 kilogram (range 38 to 128). Of note is that 49 (55.7 percent) of the patients were obese, hence required calculation of their heparin dosing weight. Mean serum creatinine of the patients was 2.6 milligram per deciliter (range 0.48 to 9.9). The mean loading dose given to the patients was 5400 units (range 3,000 to 10,000) and mean maintenance infusion was 1,100 units per hour (range 500 to 2250). The mean number of days of heparin therapy was 4.4 days (range 2 to 16 days). Pharmacist used the appropriate nomogram based on the prescribers indicated diagnosis 100 percent of the time, and accurately calculated the loading and maintenance dose 98.9 percent of the time. One patient received a slightly higher dose than was indicated because the patients weight was between two reference points and the pharmacist rounded up the weight. Nursing compliance with the protocol was as follows: two nurses acknowledged review of the pharmacist calculation by signing the dosing form 73.9 percent of the time; aPTT was obtained appropriately within 6-8 hours post bolus or dosage adjustment 64.8 percent of the time and nurses adjusted doses appropriately based on the nomogram in response to aPTT levels 92 percent of the time. Seventy-two (81.8 percent) of our patients achieved therapeutic aPTT within 24 hours. Thirty-one (35.2 percent) of the patients

achieved therapeutic aPTT within 6-8 hours after initiation of therapy, another 16 (18.2 percent) achieved therapeutic aPTT following one dosage adjustment, while 25 (28.4 percent) achieved therapeutic aPTT following a second dosage adjustment. An evaluation of patients that did not achieve therapeutic aPTT at the 3 points of analysis revealed that during the first 6-8 hours post therapy, 38 (43.2 percent) had suprathereapeutic aPTT, 19 (21.6 percent) had subtherapeutic aPTT. Of patients who required dosage adjustment at this time, 16 (18.2 percent) had suprathereapeutic aPTT, and 25 (28.4 percent) had subtherapeutic aPTT and of patients who did not achieve therapeutic aPTT after one dosage adjustment, 2 (2.3 percent) had suprathereapeutic aPTT while 14 (15.9 percent) had subtherapeutic aPTT. Hence, 16 (18.2 percent) of the patients did not achieve therapeutic aPTT within 24 hours of initiation of therapy. Of note is that obese patients achieved therapeutic aPTT within 24 hours of initiation of therapy at a higher rate than non obese patients (85.7 percent compared to 76.9 percent). One patient experienced a minor nose bleeding event. This patient was on warfarin therapy, however, his aPTT was 31.4 seconds and INR was 1.23. Heparin was not discontinued on this patient. One patient experienced a significant drop 25 percent drop in their hematocrit (40.2 percent to 30.3 percent ) and a 6.3 grams per deciliter drop in hemoglobin (16.8 grams per deciliter to 10.5 grams per deciliter) leading to discontinuation of therapy

**Conclusion:** This study indicates that majority (81.8%) of our patients achieved therapeutic aPTT within 24 hours using our heparin weight-based protocols. Pharmacist were compliant with the weight-based heparin protocol requirements, however, nurses did not obtain aPTT levels within 6-8 hours as required by protocol 35.2% of the time. This represents an area of improvement for our institution.

**5-069**

**Category:** Drug-Use Evaluation

**Title:** Evaluation of the implementation of an automatic therapeutic substitution to 3mL rapid and short acting insulin vials

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**Purpose:** The use of short and intermediate-acting insulin therapy is commonplace in the acute care hospital setting. Until very recently the only presentations of U-100 insulin products were 10mL flip-top vials and 3mL adjustable dose pens. Due to the wide variability in the duration of patient stay and dose ranges used, insulin waste was thought to be significant when patients were discharged. The purpose of this study was to evaluate waste reduction and any associated cost savings from the implementation of an automatic therapeutic substitution (ATS) of all regular, NPH and lispro insulin orders to 3mL U-100 insulin vials.

**Methods:** Traditionally at Duke University Hospital (DUH) patients requiring insulin therapy would be started on the insulin product on formulary or their home regimen. A patient-specific 10mL insulin vial is dispensed and stored in the patient specific bin of the automated dispensing cabinet located on each patient care unit. No insulin pens are used at DUH due to multiple factors including infection control concerns and nursing preference. If a patient is moved to another unit, their insulin vial is transferred with them resulting in no immediate waste. At discharge however any remaining insulin is discarded. Insulin waste had never been measured, but was thought to be significant. In late-2009, a pharmaceutical manufacturer began marketing 3mL U-100 insulin vials in addition to the traditional 10mL vials and 3mL pens. This was in essence an institutional presentation that was priced equally per mL compared to the larger 10mL vial. In an effort to reduce waste, in April 2010 all orders for regular, NPH or short acting insulin were automatically substituted with the 3mL vial. Orders were allowed to be processed for another manufacturers product if there was a documented contraindication or allergy to the manufacturer of the 3mL insulin vial or for the purposes of filling a patient's home insulin pump. To determine the impact of this substitution, the volume of mLs dispensed for all forms of regular, NPH and short acting insulin during the six month period from 10/2009-3/2010 was determined based on pharmacy dispensing records and those numbers were compared to a six month period immediately following the substitution from 4/2010-9/2010 using the same dispensing record methods. There were no other significant changes in insulin-related treatment protocols and the dispensing practice was not changed during the study period.

**Results:** During the period of 10/2009-3/2010 the average volume in mLs of regular, NPH and lispro purchased at DUH was 12,213mLs per month. We observed during the post-

implementation 6 month period that the volume purchased decreased to an average of 6865mLs per month, a decrease of 44%. Average daily census numbers were found to not be statistically different between the two study periods. Upon further review dispensing records indicated that compliance to the substitution could be improved. After implementing several changes that improved the enforcement of the substitution we observed an average monthly purchase volume of 4243mLs during the time period of 10/2010-3/2011, a 66% decrease from the pre-implementation period. All changes in volume purchased were thought to be due to waste reduction. This resulted in an average monthly savings of \$17,857 and an annualized savings of approximately \$215,000. There was no statistical difference observed in adverse event reporting related to insulin products after the ATS implementation.

**Conclusion:** Substitution of an institutional size 3mL insulin vial for all regular, NPH and lispro orders resulted in waste reduction and significant cost savings with no impact on patient safety.

**5-070**

**Category:** Drug-Use Evaluation

**Title:** Severe hypoglycemic events associated with non-guideline-concordant oral anti-diabetic drug treatments in patients with type 2 diabetes and moderate to severe chronic kidney disease: findings from a U.S. commercially-insured population

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**Purpose:** Purpose: To assess the rate of non-concordant use of oral anti-diabetic drug treatment (OAD) (according to National Kidney Foundation (NKF) guidelines) and its association with severe hypoglycemic events in patients with type 2 diabetes mellitus (T2DM) and moderate to severe chronic kidney disease (CKD).

**Methods:** Methods: Health administrative claims and laboratory findings from a US commercially-insured population were used to identify patients aged 18-64 who had two claims with associated ICD-9-CM code of T2DM (250.xx) and any stage 3-5 CKD from medical claims with associated ICD-9-CM code of 585.3-585.6 or dialysis procedures or lab findings with glomerular filtration rate less than 60 between 2005 and 2010. The date of first CKD indication was set as the index date. Patients were further selected if they filled at least 1 prescribed OAD during the 6 months following the index date (baseline period). OAD prescriptions were considered not guideline-concordant (non-GC) if they were recommended to be avoided or did not comply with recommended dosage adjustment. Severe hypoglycemic events were identified based on associated diagnosis codes after the 6 months baseline period until loss of follow-up. A Cox proportional hazards regression model was used to assess the association between non-GC and severe hypoglycemic events, adjusting for patient demographic and clinical characteristics. The study was exempted from institutional review board review since data analyzed were encrypted and in compliance with the Health Insurance Portability and Accountability Act.

**Results:** Results: Of the final study sample (N=3,300; mean age: 56.0; 37.9% female; 83.2% stage 3 CKD), 58.3% were non-GC. When assessing individual OAD use for stage 3-5 CKD patients, based on kidney function or required adjustment of dosage according to NKF guidelines, the rate of non-GC use was 94.3% for glimepiride, 12.5% for acarbose, 28.6% for miglitol, 79.9% for metformin, 89.5% for nateglinide, and 40.1% for sitagliptin. After adjusting for patient characteristics, the non-GC patients were more likely to have severe hypoglycemic events (hazard ratio: 1.24, 95 % CI: 1.03-1.49) versus GC patients.

**Conclusion:** Conclusion: The findings suggested a higher risk of severe hypoglycemic events associated with non-GC OAD treatment among T2DM patients with moderate to severe CKD. Future studies are required to support the value of closely monitoring OAD treatments to ensure they are concordant with NKF guideline recommendations.

5-071

**Category:** Drug-Use Evaluation

**Title:** Association of severe hypoglycemic risk with package insert recommended renal dose adjustments for oral anti-diabetic drug treatments among commercially insured patients with type 2 diabetes

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**Purpose:** Purpose: To assess the risk of severe hypoglycemic events associated with use of oral anti-diabetic (OAD) treatments that are not concordant with package inserts (PIs) among commercially-insured patients with type 2 diabetes mellitus (T2DM) and chronic kidney disease (CKD).

**Methods:** Methods: Medical, pharmacy claims and laboratory findings dated 2005-2010 from a U.S. commercially-insured population were analyzed. T2DM patients (identified based on two claims with associated ICD-9-CM code of 250.xx) aged 18-64 with stage 3-5 CKD (identified based on at least one medical claims with associated ICD-9-CM code of 585.3-585.6 or dialysis procedures or lab findings with glomerular filtration rate less than 60; the date of the first CKD indication denoted as the index date) were included in this study. Patients who filled prescriptions of OAD within 6 months (baseline period) following the index date were included and concordance of use based on the PIs recommendations for renal impairment was determined. Patients were considered not concordant if OADs were prescribed when recommended to be avoided, or without recommended dose adjustments. Severe hypoglycemic events identified from medical claims using a published algorithm following the 6 months baseline period were evaluated until loss of follow-up. Cox proportional hazards regression was used to estimate the risk of severe hypoglycemic events associated with OAD treatment according to PIs recommendations, adjusting for patient demographic and clinical characteristics. Data analyzed were encrypted and compliant with the Health Insurance Portability and Accountability Act; the study was exempted from institutional review board review.

**Results:** Results: The final study sample included 3,300 T2DM patients with stage 3-5 CKD (mean age: 56.0; 37.9% female; 83.2% stage 3 CKD), of which 74.4% had OAD utilization outside of PI recommendations. The rate of non-concordant use was 97.3% for glyburide, 94.4% for glipizide, 94.0% for glimepiride, 12.5% for acarbose, 28.6% for miglitol, 78.7% for metformin, 15.5% for repaglinide, and 35.8% for sitagliptin. After adjustment for patient

characteristics, non-PI-concordant patients had 35% higher risk of severe hypoglycemic events (hazard ratio: 1.35, 95 % CI: 1.10-1.67).

**Conclusion:** Conclusion: These findings suggest a higher risk of severe hypoglycemic events associated with OAD treatments not concordant with PI recommendations for renal impairment among T2DM patients with stage 3-5 CKD. Efforts should be made to monitor OAD treatments when managing these patients in clinical practice.

5-072

**Category:** Drug-Use Evaluation

**Title:** Treatment of recurrent *Clostridium difficile* infections in hospitalized patients with implications for the Veterans Administration budget

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**Purpose:** Oral vancomycin has been the only FDA-approved treatment for *Clostridium difficile* associated infections (CDAI) until fidaxomicin (Dificid) was recently approved in May 2011. This analysis reviews the clinical and economic literature and estimates the budgetary impact of the use of fidaxomicin in place of oral vancomycin for the treatment of recurrent *Clostridium difficile* infections by exploring costs from the perspective of the Veterans Administration healthcare system.

**Methods:** A systematic literature review of clinical and economic studies of fidaxomicin treatment for CDAI was performed. A budget impact analysis (BIA) based on economic factors affecting CDAI treatment cost including CDAI recurrence rates, additional lengths of hospital stay, additional physician costs, and number of patients, was conducted to determine total treatment cost with oral vancomycin or fidaxomicin for two CDAI recurrences. Data were extrapolated from the Veterans Administration demographic and cost data. One-way sensitivity analyses were performed for treatment costs and *Clostridium difficile* second recurrence rates to account for uncertainties in the data.

**Results:** Clinical studies show similar efficacy and safety between fidaxomicin and vancomycin. However, fidaxomicin had a much lower first CDI recurrence rate. A comprehensive literature search yielded no available economic data comparing fidaxomicin to oral vancomycin. BIA results established that fidaxomicin has a cost-savings potential of \$1099 per person if used in place of standard of care, vancomycin with metronidazole, in patients with recurrent CDAI. The reference case scenario shows total costs after two CDI recurrences of \$97,351,054 with fidaxomicin treatment versus \$289,705,089 with vancomycin treatment. Sensitivity analysis of fidaxomicin's second recurrence rate showed continuous cost-savings when rates were varied 14% to 42%. Fidaxomicin maintained cost-savings even at 100% second recurrence rate. Analysis of physician costs showed continuous cost-savings when costs varied from 10% to 25% of hospitalization cost.

**Conclusion:** Based on the BIA, fidaxomicin may be clinically and economically beneficial in patients at risk for recurrent CDAs. Additionally, the robustness of the data demonstrated from

the sensitivity analyses indicated that the findings were robust for fidaxomicin's second recurrence rate and physician costs. Future clinical trials examining recurrence rates for a second episode of fidaxomicin and treatment costs would be beneficial to further validate the economic benefit of using fidaxomicin in therapy to treat and prevent recurring CDAI.

5-073

**Category:** Drug-Use Evaluation

**Title:** Clinical and economic evaluation of etanercept for treatment of patients with rheumatoid arthritis with implications on the MassHealth budget (2011)

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**Purpose:** The purpose of this clinical and economic evaluation was to determine whether treatment with etanercept for patients with treatment-refractory rheumatoid arthritis (RA) is a feasible option in comparison to two other commonly used tumor necrosis factor-alpha (TNF-alpha) antagonists, infliximab and adalimumab. In this analysis, treatment-refractory RA was defined as previous treatment failure with a disease-modifying antirheumatic drug (DMARD) alone, such as methotrexate. Currently, all TNF-alpha antagonists require a prior authorization under MassHealth, the Massachusetts state Medicaid program, due to the high costs and risks associated with using these agents. The goal of this analysis was to provide the most budget-appropriate treatment for patients with RA from a MassHealth payer perspective, which would allow them to make formulary decisions in regards to the use of TNF-alpha antagonists for the treatment of refractory RA.

**Methods:** All TNF-alpha antagonists have similar efficacy in the treatment of RA and according to the American College of Rheumatology (ACR) treatment guidelines, no single agent is preferred over another. For this reason, a budget impact analysis and economic evaluation was performed to determine which agent would be most appropriate for use from the MassHealth payer perspective. Since both etanercept and adalimumab are indicated for the treatment of RA as monotherapy, while infliximab is only indicated for treatment along with a DMARD, the analysis reflected the associated additional costs. Etanercept versus adalimumab and etanercept versus infliximab were compared to determine which course of therapy would result in the lowest costs per year of therapy. All three therapies require certain monitoring parameters initially as well as throughout treatment, including an initial visit to a rheumatologist, a complete blood count, a hepatitis B screening, rheumatoid factor levels, and a tuberculin skin test. The three TNF-alpha antagonists have different requirements for monitoring and laboratory testing, frequency of adverse events, and the ability to be used concomitantly with other medications. Each of these costs was included in the analysis. The costs associated with using both infliximab and adalimumab were compared independently to the costs with using etanercept.

**Results:** The costs for one year of therapy with each TNF-alpha antagonist was determined by assigning each laboratory value, monitoring parameter, and treatment of significant adverse events a predetermined cost. The maximum cost was found by the assumption that all monitoring would be completed and that each adverse event would occur during the treatment course and be treated. Through budget impact analysis, the final cost of etanercept was determined to be \$22,562. The cost of adalimumab was \$43,948 and the cost of infliximab was \$38,036.

**Conclusion:** According to the economic evaluation of the three TNF-alpha antagonists, etanercept is a feasible option in comparison to adalimumab and infliximab for outpatient treatment of RA when methotrexate alone has failed. Patients taking etanercept have a lower risk of developing tuberculosis and require less monitoring when compared to adalimumab. There is also a lower risk of developing infections, including tuberculosis, with etanercept versus infliximab. For these reasons, etanercept appeared to have a better safety profile, with less associated adverse events requiring costly treatment, and therefore, lower costs associated with using this agent. Based on the calculations performed in the budget impact analysis, etanercept is appropriate for implementation to the MassHealth formulary with no restrictions.

5-074

**Category:** Drug-Use Evaluation

**Title:** Implementation of a pharmacist driven erythropoietin stimulating agent program

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**Purpose:** To compare data pre and post implementation of an erythropoietin stimulating agent (ESA) pharmacist driven protocol and assess proper use of iron supplementation.

**Methods:** A retrospective review of erythropoietin stimulating agent (ESA) use was done over a period of two months assessing for indication, pertinent labs, dosing, and appropriate iron supplementation. A need for improvement in ESA use was identified; and an order form, along with a monitoring policy was developed. Pharmacists were educated on the new policy, promoting judicious use of ESAs and enforcing compliance with the ESA APPRISE Oncology Program. Consequently, a prospective review was done to assess the effectiveness of the program and pharmacists impact on ESA usage.

**Results:** Prior to program implementation, 38 percent (10/26) of patients had iron studies, 28 percent (2/7) received supplemental iron when indicated, and an ESA was administered to all patients with a hemoglobin that exceeded target levels. After implementation of the program, 81 percent (22/27) had iron studies, and pharmacists were able to add iron to 57 percent (4/7) of patients that required supplemental iron. This resulted in a 43 percent increase in baseline iron studies, and a 29 percent increase in supplemental iron. Furthermore, pharmacists held the dose 66 percent (4/6) of the time when the hemoglobin was above target.

**Conclusion:** Implementation of an ESA pharmacist driven program resulted in a 43 percent increase in baseline iron studies, a 29 percent increase in supplemental iron when needed, and a 66 percent decrease in misuse when hemoglobin was above target.

5-075

**Category:** Drug-Use Evaluation

**Title:** Effect of obesity on continuous weight-based heparin infusions

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**Purpose:** Continuous weight-based heparin protocols are used to achieve anticoagulation in patients presenting with Acute Coronary Syndromes (ACS). Dose capping is used in obese patients for bolus and infusion initiation per the Continuous Weight-Based Heparin ACS Protocol. The purpose of this study was to determine whether Body Mass Index (BMI) has an impact on time to therapeutic anticoagulation, time within the therapeutic range, and safety.

**Methods:** The Pharmacy and Therapeutics Committee approved this retrospective medication-use evaluation prior to data collection. Adult patients initiated on the Continuous Weight-Based Heparin ACS Protocol for a minimum of 24 hours were included. Patients were excluded if the date and time of heparin initiation were unable to be identified. The electronic medical record was used to identify patients. Demographic information was collected including patient age, weight, height, and gender. Time of heparin initiation; baseline and subsequent anti-Xa levels and times; and heparin bolus dose and initial infusion rate were recorded. BMI was calculated. Patients with BMI greater than or equal to 30.0 were classified as obese (n equals 20) and BMI less than or equal to 29.9 were classified as non-obese (n equals 29). The primary outcome measure was time to therapeutic anticoagulation (anti-Xa level range 0.3 to 0.7 units/mL). Secondary outcome measures included percent of anti-Xa levels within the therapeutic range and change in hemoglobin from baseline.

**Results:** Mean time to therapeutic anticoagulation in the non-obese group was 15.7 hours and the obese group was 9.78 hours. The percent of anti-Xa values drawn within the goal range was 62% in the non-obese group and 54.5% in the obese group. Anti-Xa levels were subtherapeutic in 33.7% and 36.3% in the non-obese and obese patients respectively. In non-obese patients, 4.3% of anti-Xa levels drawn were suprathreshold compared to 9% in the obese population. There were no differences in hemoglobin change from baseline between the two groups.

**Conclusion:** Obese patients were associated with shorter times to therapeutic heparin levels compared with non-obese patients. However, the obese patients had a higher percent of anti-Xa levels outside the goal range. No difference in safety was observed between the two groups of patients. The clinical significance of obesity on weight-based heparin protocols must be determined by further clinical study.

5-076

**Category:** Drug-Use Evaluation

**Title:** Evaluation of Acetaminophen Prescribing & Administration in a Level 1 Trauma Center

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**Purpose:** Unintentional over use of acetaminophen (APAP) has been attributed to the use of combination APAP products. This risk was highlighted by the FDA in 2011, which recommended a limit on all APAP combinations to 325 mg. Furthermore, it gave APAP a Black Box Warning label. Prescribing APAP and its combination products in a hospital setting has had limited review. The aim of this study is to evaluate APAP prescribing and administration in a tertiary care hospital and to answer the following questions: 1) Was 4 grams/day of APAP exceeded? 2) Was 2 grams/day of APAP exceeded in high-risk patients?

**Methods:** Institutional review board approved study. Inclusion criteria: 18 years of age on an oral APAP product and admitted to medical, surgical, or telemetry floor. Exclusion criteria: patients on Trauma or Critical care floor and on liquid APAP formulations. Maximum dose was defined as 4 grams in healthy adults and 2 grams in high-risk patients in a 24-hour period. High-risk patients included those with history of alcohol abuse or hepatitis as defined in the medical record. Enrolled patients were evaluated for their entire length of stay. Data from the online electronic database along with the automated dispensing system (Pyxis) were used.

**Results:** 176 patients were enrolled in the study. 31 patients were considered high risk. 52% were males, and 48% were females. 6 of 176 patients (3.48%) received more than 4 grams. Only 1 patient (0.57%) exceeded daily APAP recommendation limit more than once. In high-risk patients, 9 of 31 patients (29.03%) exceeded the 2 gram limit. Prescribing rates revealed APAP 325 mg alone was the most often prescribed (77%), followed by hydrocodone (5/500 mg at 40%) and oxycodone (5/325 mg at 35%) combinations. APAP use increases with greater than 4 days length of stay (LOS).

**Conclusion:** This pilot study in 176 patients shows that APAP prescribing and administration met recommended dosing limits 97% of the time in our inpatient setting. Exceeding the 2 gram/day limit in our vulnerable patients is an area for further attention though clinical significance of this limit at this time is not well studied. Electronic APAP calculation tools will be required to guide clinicians in the future with FDA mandates as manual analysis is cumbersome.

5-077

**Category:** Drug-Use Evaluation

**Title:** One day focus on antivitamins K (AVK) drug interactions: pathing the way for a computerized assisted prescription

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**Purpose:** In France approximately 600000 people are treated with AVK drugs (which represent 1% of the total population). They are the first cause of drug toxicity events toward the country. National wide epidemiologic studies on medicine adverse effects, the ENEIS studies, leaded in 2004 and 2009 showed that AVK drugs were responsible of respectively 37 and 31percents of all drug toxicity events. (50 percents could be avoided).From an hospital to another, all prescription cannot be daily monitored by the pharmacist leading medical and pharmaceutical staff to design preventive actions on the monitoring of AVK. The purpose of this study was first to determine the prevalence of AVK treatment in hospitalized patients, then find out the number of specific interactions between AVK and the other drugs in the patients prescription, analyse its impact on the International Normalised Ratio (INR) and finally make recommendations to improve AVK prescription and follow-up of

**Methods:** The study was realizes on behalf of the institutional review board (IRB) and consisted on a one day focus on all patients receiving AVK. Part of the same hospital group, Henri Mondor and Albert Chenevier hospitals has respectively 900 beds of acute term care units and 400 beds of sub-acute and long term care units. On May 30th ,2012, all computerized patient prescriptions were screened by means of our prescription software in order to select those containing AVK. French health regulatory agency (ANSM) established a 4 grade scale of interactions with AVKdrugs set by order of importance: contraindication, not recommended, use with caution, interaction to be considered. This scale has been applied to the drug interactions found. For the selected prescriptions, patients INR and target value were also collected

**Results:** 71 prescriptions containing AVK drugs were detected and 1/3 of patients concerned were aged of 75 or over. AVK reparation was 83 percents of fluindione, 13 percents of warfarin and 4 percents of acenocoumarol. Only 6 prescriptions over the 71 presented no interaction. On the 68 remaining prescriptions 168 drug interactions were listed: none as contraindications, 1 percent as not recommended, 82 percents as to use with caution, 18 percents as to be considered. Top 6 drugs responsible of interactions were: amiodarone (20 percents), low dose aspirin (15 percents), HMGcoA reductase inhibitors (14 percents), serotonin reuptake inhibitors (10 percents), full dose acetaminophen (7 percents), tramadol (7 percents) and thyroid supplement (6

percents). 3 percents of interactions listed would decrease AVK effect, as 77 percents would increase it and 20 percents would have no significative influence. Prescription contained from 0 to 7 drugs interactions regarding AVK treatment. Of the 71 patients with AVK drugs prescriptions, 61percents had none to two interactions with their AVK treatment, whereas 39 percents had more than 3 drug interactions. INR was within the target fixed by the physician for 41 patients (56 percents), 11 patients (15 percents) had infra therapeutic INR (most of time switch from heparin or low molecular weight heparin to AVK in progress). By the way 11 patients (15 percents) had also supra therapeutics INR. In 9 percents of cases, INR dosage or target data where missing.

**Conclusion:** As IRBs will to enforce security on AVK prescription grow every day stronger, this study was followed by new recommendation on AVK drug interactions for prescribers. This study also opens the way to warning optimisation in the prescription software and especially on drug interacting withAVK.

**5-078**

**Category:** Emergency Medicine / Emergency Room

**Title:** Parent and staff satisfaction with local anesthesia prior to IV starts in a pediatric emergency room

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**Purpose:** Venipuncture for the purpose of establishing intravenous (IV) access in children can be a painful and thus traumatic event for both child and parent. In an effort to decrease the pain associated with this procedure, a pilot project was conducted using a needleless injector device to inject a local anesthetic prior to the insertion of a venous cannula. As part of the pilot, a survey was conducted to evaluate the subjective responses of both the staff and parent/child in terms of pain reduction and ease of use. This report summarizes the results of this survey.

**Methods:** During the four month period of October 2012 through January 2012, a limited group of ED nurses were trained to administer intradermally 0.2 ml of lidocaine 1% buffered with sodium bicarbonate via a needleless injector. The needleless injectors were available commercially and utilized a compressed gas to inject a small volume of liquid. The device accepted up to 0.25 ml for injection but only 0.20 ml was routinely loaded into the device. The buffered 1% lidocaine used during the study was purchased from a different pharmaceutical manufacturer in the form of 3 ml prefilled syringes. Once trained, these ED nurses began randomly offering the parents of pediatric patients requiring an IV the opportunity for their child to receive this injection prior to any attempt to establish IV access. A total of 116 parents agreed to have their child undergo the procedure. Following each procedure, a survey was completed by the child and/or one of the parents and the staff member who administered the local anesthetic and started the IV. The survey consisted for seven questions, four for the child/parent and three for the staff member. The questions were as follows: Child/Parent Questions: #1-How much pain did you have when your IV was started? (0-10); #2-Would you want the numbing device again the next time you have an IV? (yes, no); #3-How much pain relief did the device provide your child for the IV start? (none, some, good, excellent); #4-Would you want the device used for your child again? (yes, no). Staff Questions: #1-Please rate the pain relief provided by the procedure during the IV start. (none, some, good, excellent); #2-Did the device interfere with obtaining venous access? (yes, no); #3-How much did the procedure impact your workflow? (considerably-would not use again, somewhat but worth it to the patient, minimally, not at all)

**Results:** Results: Of the 116 patients who received the local anesthetic prior to peripheral venous cannulation, completion rates of the individual questions in the questionnaire were as follows: #1-81%, #2-87%, #3-98%, #4-98%, #5-99%, #6-99%, #7-98%. Question #1- How much pain did you have when your IV was started? 0-66%, 1-16%, 2-11%, 3-2%, 4-2%, 5-0%, 6-2%, 7-0%,

8-0%, 9-1%, 10-0%. Question #2- Would you want the numbing device again the next time you have an IV? Yes-99%, No-1% Question #3-How much pain relief did the device provide your child for the IV start? None-3%, Some-8%, Good-17%, Excellent-72% Questions #4-Would you want the device used for your child again? Yes-97%, No-3% Question #5-Please rate the pain relief provided by the procedure during the IV start. None-5%, Some-5%, Good-19%, Excellent-71% Question #6-Did the device interfere with obtaining venous access? Yes-7%, No-93% Question #7-How much did the procedure impact your workflow? Considerably-would not use again-0%, Somewhat but worth it to the patient-4%, Minimally-23%, Not at all-73%.

**Conclusion:** The administration of a local anesthetic using a needleless injector prior to an IV start provided significant pain relief and was overwhelmingly accepted by pediatric patients, parents and nursing staff in a pediatric emergency room. When asked how much pain they experienced, 82% of patients reported that they had 0-1 level of pain (maximum= 10). When the perceptions of pain relief in the same child were compared between parent and ED staff member, the responses were nearly identical with 72% of parents and 71% of staff members feeling that excellent pain relief was achieved. Almost all parents, 97%, reported that they would want the procedure used again for their child if needed in the future. The procedure did not significantly impair the ability of the bedside nurse to obtain IV access and 96% of the nurses felt that it minimally or not-at-all impacted their workflow. As a result of the positive outcomes found this study, this procedure was approved for use on all patients requiring venous access.

5-079

**Category:** Emergency Medicine / Emergency Room

**Title:** The Emergency Pharmacist as Influenza Immunization Officer

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**Purpose:** Annual immunization of health-care personnel (HCP) against influenza reduces infection and absenteeism and improves patient outcomes, including mortality. Despite proven benefits, annual rates of immunization are historically very low. Lack of access and inconvenience are two reasons HCP frequently give for not being vaccinated. The Emergency Department (ED) is a hub within the hospital and is open 24 hours per day, 7 days a week. With minimal additional training, pharmacists can provide vaccinations without the need for a physician order. They are ideally suited to answer questions about safety and efficacy of immunization. A pharmacist-run vaccination clinic in the ED may improve access for HCP who otherwise have difficulty presenting to Employee Health or mass-vaccination clinics held during the day. This study is a feasibility project of a pharmacist-run influenza vaccination clinic based in the ED.

**Methods:** This project was completed in the ED of a large, tertiary care, academic hospital in Tucson, AZ. All HCP associated with the hospital and physician group, roughly 6,000 employees, were included in the intervention. Beginning in September 2011, promotional materials were distributed throughout the hospital and via hospital listserv. Pharmacists trained in immunization staffed a clinic based out of a conference room just outside the ED for two hours from 6-8 pm Monday-Friday from Sept 30-Oct 26, 2011. Upon closure of the clinic, a survey was distributed via listserv to employees of the hospital to assess attitudes towards the ED clinic and influenza vaccination in general. The department of origin as well as the job descriptions of vaccinees at the ED clinic and the entire vaccinated population were compared with two sample tests of proportions. A qualitative analysis of free text responses to the prompt In what way could we improve influenza vaccination for all employees? was performed.

**Results:** Pharmacists vaccinated 259 HCP the ED clinic, representing 11.4% of all 2011-2012 influenza vaccinations delivered and 4.3% of all HCP in the hospital. Of vaccinees, participants in the ED clinic were much more likely to be involved in direct patient care (75.8% vs 53.5%,  $p<0.05$ ) and were more likely to work in the ED (27.4% vs 1.9%,  $p<0.05$ ) the pharmacy (8.5% vs 2.3%,  $p<0.05$ ) or security (3.5% vs 1.1%,  $p<0.05$ ). Participants in the ED clinic were more likely to be physicians or housestaff as compared to the overall vaccinated group (9.7% vs 2.1%,

p<0.05 and 15.8% vs 3.2%, p<0.05 respectively). 913 responded to the online survey, 73% of whom were vaccinated for influenza this year. Of those not vaccinated, the most commonly cited reasons were I dont need to be vaccinated, I never get sick (32%); I always get sick after a flu shot (28%); and too inconvenient (22%). Responses about improving access were heavily represented in the qualitative analysis of free text responses.

**Conclusion:** The ED is a central location ideal for vaccination of hospital-based HCP. Pharmacists are effectively able to vaccinate HCP in this setting. An ED-based vaccination clinic is more likely to capture direct patient care providers, HCP in the ED, the pharmacy and security. Misperceptions of influenza risk and vaccination side effects are frequently cited reasons for forgoing vaccination in the HCP population.

**5-080**

**Category:** Emergency Medicine / Emergency Room

**Title:** Impact of clinical pharmacists on initiation of post-intubation analgesia in the emergency department

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**Purpose:** Pain and anxiety are common in mechanically ventilated patients. Unfortunately, use of post-intubation analgesics in the emergency department (ED) is often inadequate or absent. While this deficiency has been described in emergency medicine literature, there are currently no published reports of methods that successfully improve the provision of analgesia after intubation. Upon implementation of clinical pharmacy services in a community hospital ED, knowledge deficits and operational barriers to pain control were identified and addressed. The objective of this study is to compare the rate of initiation of post-intubation analgesia in the ED before and after education and intervention by clinical pharmacists specialized in emergency medicine.

**Methods:** This retrospective cohort study was approved by the institutional review board. Potential subjects were identified through a review of electronic medication orders placed during two six month periods before and after clinical pharmacist involvement in the ED. Men and women aged 18 years and older were included if they underwent rapid sequence intubation (RSI) in the ED and remained in the department for at least 30 minutes after intubation. Exclusion criteria included RSI secondary to cardiac arrest or opioid or benzodiazepine overdose, documented opioid allergies, documented avoidance of analgesia due to hypotension, direction of post-intubation care by non-ED providers, and patient expiration while in the ED. A convenience sample of 50 patients was expected for each group. The primary endpoint was initiation of post-intubation analgesia, with a subset analysis of patients who underwent RSI during the ED pharmacist duty hours (approximately 10am-8:30pm daily). Secondary endpoints included frequency of sedative or anxiolytic use without analgesia, time to initiation of post-intubation analgesia, and documented adverse drug reactions resulting in the discontinuation of analgesia in the ED. Regimens were compared statistically using SPSS version 18 (SPSS, Inc., Chicago, IL).

**Results:** Forty-one patients were included in each group due to low frequency of true rapid sequence intubation in the pre-intervention time period. There was a significant increase in the overall rate of initiation of post-intubation analgesia after clinical pharmacist intervention, from 20% to 49% ( $p=0.005$ ). Accordingly, more patients in the pre-intervention group received sole sedative or anxiolytic therapy after intubation (73% vs 51%,  $p=0.04$ ). A small number of patients in the pre-intervention group (7%) received neither sedation nor analgesia in the ED after

intubation. In the post-intervention group, 59% of included intubations took place during the time the ED pharmacist was on duty; 85% of analgesia initiation occurred during these hours. There was a marked decrease in time to initiation of post-intubation analgesia, from 98 minutes before pharmacist intervention to 45 minutes after. Adverse drug reactions were rare; there were no discontinuations of analgesic therapy in the pre-intervention group and one temporary discontinuation due to hypotension in the post-intervention group.

**Conclusion:** Analgesic use after rapid sequence intubation in the emergency department significantly increased after the implementation of ED clinical pharmacy services. The large proportion of patients receiving analgesia during the ED pharmacists' duty hours suggest the increase may be due to direct pharmacist involvement in post-intubation management.

**5-081**

**Category:** Emergency Medicine / Emergency Room

**Title:** Utilization of a Clinical Pharmacist to Enhance the Safety and Quality of Medication Reconciliation Initiated in the Emergency Care Center

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**Purpose:** To explore the opportunities for enhanced patient care by dedicating a clinical pharmacist to the Emergency Care Center (ECC).

**Methods:** A Clinical Pharmacist was dedicated to the ECC with a focus on obtaining medication histories to initiate the medication reconciliation process. The Clinical Pharmacists primary goal was to provide an accurate and complete medication reconciliation document for the admitting physician to use as admission orders. Without prior establishment of pharmacy services in the ECC, the Clinical Pharmacist was charged with developing ECC Pharmacy Services. The role of the Clinical Pharmacist became more dynamic as the Emergency Care Team became familiar with and dependent upon the Clinical Pharmacist. Pharmacy Services quickly expanded to consultation for appropriate medication dosing, assistance with critical care patients, expediting medication delivery and administration, medication reconciliation and many other areas which all serve to enhance quality of care.

**Results:** Two-thirds of all interventions recorded by the Clinical Pharmacist involved obtaining medication histories for the purpose of medication reconciliation. This accounts for 27% of hospital admissions initiated from the ECC in the survey period even though the Clinical Pharmacist was only present in the ECC for 40 hours each week. Clinical Pharmacist Services expanded beyond Medication Reconciliation soon after entering the ECC. The ECC team called upon the Clinical Pharmacist to provide real time drug information, assist with critically ill patients, Code 99 (Code Blue) and trauma patients, expedite medication therapy preparation and administration, and entrusted the Clinical Pharmacist with countless other responsibilities.

**Conclusion:** Clinical Pharmacy services in the Emergency Care Center enhance the safety and quality of medication histories and the medication reconciliation process. Although the primary focus was on medication reconciliation, the clinical pharmacist has become an indispensable part of the Emergency Care Team

**5-082**

**Category:** Emergency Medicine / Emergency Room

**Title:** Development of a standardized emergency department order set for initiation of high-dose insulin therapy for beta-blocker and calcium channel blocker overdose

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**Purpose:** Four cases of -blocker and calcium channel blocker (CCB) poisoning utilizing treatment with high-dose insulin therapy (HDIT) were reviewed at our institution. Upon evaluation multiple inconsistencies were noted generating concerns for patient safety and opportunities to modify our practice through evidence-based care. Standardized order sets are a common practice within our health-system and we recognized the need to develop an order set for initiation of HDIT in the emergency department. Additionally, a uniform approach allows for non-emergency medicine trained pharmacists to optimize this emerging treatment regimen.

**Methods:** Review of literature, Poison Center treatment protocols, consultation from toxicology experts and a retrospective review of HDIT cases within our institution guided the development of the order set. Patients were treated utilizing a protocol adapted from the Toxicology Service at Regions Hospital in St. Paul and Hennepin Regional Poison Center in Minneapolis, Minnesota. For each of the cases we compared medications ordered and administered, laboratory tests, and hemodynamic monitoring.

**Results:** Among the medications ordered variations were found in insulin concentrations, calcium salt formulations, dextrose concentrations, potassium replacement, vasopressor use and activated charcoal. Inconsistencies in laboratory tests obtained or omitted included extended intervals between blood glucose measurements, baseline ionized calcium, lactate, and arterial blood gas. Arterial line and central venous access for hemodynamic monitoring differed between cases. An order set for initiation of HDIT in the emergency department was developed and reviewed by emergency medicine pharmacists and physicians and approved through the pharmacy and therapeutics committee. It includes recommendations for physician consults, nursing cares, laboratory tests, electrocardiogram evaluation and medication administration. Final implementation into the electronic medical record is pending.

**Conclusion:** Through the development of a standardized order set for initiation of HDIT in the emergency department we aim to eliminate inconsistencies, reduce monitoring and therapeutic variation, and optimize patient safety.

**5-083**

**Category:** Emergency Medicine / Emergency Room

**Title:** Assessing the time to antibiotic administration in septic shock patients with pharmacy services in the emergency department

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**Purpose:** The Surviving Sepsis Campaign guidelines for management of severe sepsis and septic shock recognize that prompt initiation of antimicrobial therapy within one hour of suspicion is critical in optimizing patient outcomes. Currently pharmacists staffing in the emergency department (ED) at Robert Wood Johnson University Hospital provide their services from Monday through Friday over two shifts from 7:30 AM to 10:30 PM. One of the daily activities of the ED pharmacist is directly providing antibiotic therapy to patients. During the off hours, antibiotics are provided from the main pharmacy. The objective of this study was to determine if antibiotic therapy is delayed in septic shock patients when ED pharmacy services are not available.

**Methods:** Patients were identified utilizing the health systems electronic medical record system (Sunrise Clinical Manager) and the Emergency Department Information Manager (EDIM). Patients younger than 21 years of age were excluded from this study. The study was conducted retrospectively over a six month period in which the following data was collected: order time of antibiotic, antibiotic order verification time by pharmacy, administration time of antibiotic, and antibiotic utilized for treatment. The time from ordered antibiotics to the documented antibiotic administration time during ED pharmacy services was compared to when ED pharmacy services were not available. The time frame between ordering antibiotics to administration of antibiotics was compared during these two time periods to determine primary outcome. IRB approval was obtained for the study.

**Results:** Overall, 35 orders in 20 patients met inclusion criteria. Only orders for the first antibiotic administered were included, which resulted in evaluation of 20 orders. Within these orders, the average time to antibiotics was less than one hour in both groups. The average time to antibiotic administration for Main pharmacy was 45.57 minutes versus 36.25 minutes for the ED pharmacy group. Three of the orders from the ED pharmacy had times of administration of zero minutes because antibiotics were administered immediately after orders were placed. The most frequently administered antibiotic was piperacillin/tazobactam.

**Conclusion:** Antibiotic therapy was administered to septic shock patients within one hour from the ordered time when ED pharmacy services were not available. The time to administration of

antibiotics was faster with ED pharmacy services in comparison to antibiotics provided by Main pharmacy. It can be observed that the presence of ED pharmacists expedites the administration of critical time sensitive antibiotics in the setting of septic shock.

**5-084**

**Category:** Emergency Medicine / Emergency Room

**Title:** High-dose insulin therapy for beta-blocker and calcium channel blocker overdose: case series

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**Purpose:** High-dose insulin therapy (HDIT) has emerged as a first line therapeutic option for the treatment of severe beta-blocker and calcium channel blocker (CCB) toxicity. The rationale for the favorable effects of this therapy is based on insulin's positive inotropic properties. We review 4 cases of beta-blocker and CCB poisoning utilizing HDIT as the initial therapy in the emergency department (ED) at our institution.

**Methods:** This is a retrospective case series of patients treated with HDIT as the primary intervention for beta-blocker or CCB overdose at Mercy Hospital in Coon Rapids, MN from September 2011 to May 2012. Patients were treated utilizing a protocol adapted from the Toxicology Service at Regions Hospital in Saint Paul, MN and the Hennepin Regional Poison Center in Minneapolis, MN. We reviewed insulin bolus and infusion dosages and durations, monitoring parameters, and dextrose bolus and infusion support for each case. Duration of hospitalization was also evaluated during our review.

**Results:** Four patients were treated with HDIT during the specified time frame. Metoprolol and amlodipine, 2 cases each, were the primary toxicities; however, all cases involved polysubstance overdose (possible coingestants included zolpidem, hydrocodone, lorazepam, benazepril, hydrochlorothiazide, and alcohol). Standard therapy including intravenous (IV) fluid resuscitation, calcium, atropine, and vasopressors were utilized in some cases; however, HDIT was initiated promptly in all 4 cases and was the primary ongoing treatment. Mean time of HDIT initiation from ED arrival was 1.3 hours (range 0.4-2.3 hours). In each of the cases, patients received a 1 unit/kg IV bolus dose of regular insulin followed by a continuous IV insulin infusion initiated at 1 unit/kg/hour. Two of the patients required titration of the insulin infusion to the maximum recommended rate of 10 units/kg/hour to maintain adequate cardiac output (CO). Mean arterial pressure and systolic blood pressure were used as preliminary surrogate markers to measure CO in lieu of more invasive monitoring techniques and lack of available means to directly measure CO. One patient required additional hemodynamic support with multiple vasopressors after the insulin infusion was maximally titrated. The mean duration of insulin infusion was 10.8 hours (range 4.7-20.4 hours). Each patient was initiated on dextrose 10% continuous IV infusion with dextrose 50% IV bolus doses as needed to sustain euglycemia. Three of the 4 patients were transitioned to more concentrated dextrose infusions (range dextrose 20-50%) for volume restriction due to fluid overload. All patients survived to hospital discharge

and were neurologically intact with mean hospital stay (exclusive of psychiatric admission) of approximately 3.4 days (range 1.9 - 4.7 days).

**Conclusion:** HDIT as initial therapy for beta-blocker and CCB toxicity has been documented in the literature. Studies thus far are based on animal models and case series similar to ours. The successful outcomes from this case series support use of HDIT as an early treatment option for beta-blocker and CCB poisoning. Limitations of our case series include the retrospective nature of the data, small sample size, lack of CO measurements, and significant variation in implementation of additional therapies including vasopressor support. Prospective studies using this therapy and comparisons to standard therapy with CO measurements in humans are still needed.

**5-085**

**Category:** Emergency Medicine / Emergency Room

**Title:** IV droperidol and olanzapine as adjuncts to midazolam for the acutely agitated patient: a multi-centre, randomised, double-blind, placebo-controlled, clinical trial

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**Purpose:** To determine if IV droperidol or olanzapine, as adjuncts to midazolam administration, improve sedation quality for the acutely agitated ED patient

**Methods:** We undertook a randomised, double-blind, placebo-controlled, double-dummy, clinical trial in three EDs (August 2009 to March 2011). Adult patients requiring IV drug sedation for acute agitation were enrolled. Each was randomized to receive an IV bolus of either saline (control), droperidol (5mg) or olanzapine (5mg). This bolus was immediately followed by an IV midazolam bolus (2.5-5mg) then additional boluses until sedation to a pre-determined endpoint was achieved. The primary outcome was time to sedation. Secondary outcomes were the need for rescue sedation and adverse events.

**Results:** 336 patients were enrolled. The baseline characteristics of the groups did not differ ( $p>0.05$ ). However, the median (IQR) times to sedation (min) differed significantly ( $p<0.001$ ): control group 10 (4-25), droperidol 6 (3-10), olanzapine 5 (3-10). At any time point, patients in the droperidol and olanzapine groups were ~1.6 times more likely to be sedated compared to controls: droperidol and olanzapine group hazard ratios (95%CI) were 1.58 (1.21-2.06) and 1.64 (1.25-2.15), respectively, ( $p=0.001$ ). The droperidol and olanzapine groups required less rescue sedation and alternative drug use at any time after initial sedation had been achieved ( $p<0.05$ ). The group adverse event profiles and lengths of stay did not differ ( $p=0.21$  and  $0.32$ , respectively).

**Conclusion:** Droperidol or olanzapine administration, as adjuncts to midazolam, is safe and significantly improves sedation quality. These findings will inform best-practice for sedation of the acutely agitated ED patient.

**5-086**

**Category:** Emergency Medicine / Emergency Room

**Title:** Compliance with pneumonia core measures in the emergency department: it takes a village

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**Purpose:** Compliance with pneumonia core measures is a priority in the emergency department (ED). The purpose of this study is to document the results of the collaborative work between the ED clinical pharmacist and other members of the healthcare team in order to improve compliance with pneumonia care quality indicators in the ED.

**Methods:** Compliance with ongoing Clinical Process Measures (formerly National Hospital Quality/Peer Review Core Measures) for pneumonia were evaluated and compared for the years 2008 and 2011 in randomly selected charts for patients with pneumonia. Since 2008 at our institution, a formalized process was developed which included targeted education, designated responsibilities and implementation of a pneumonia group collaborative, all aiming to improve our compliance with the pneumonia measures. Core measures targeted by the team included the (1) initial antibiotic selection for immunocompetent-non-ICU patient, the (2) initial antibiotic selection for immunocompetent-ICU patient, the (3) blood cultures time is documented before antibiotics given and (4) antibiotic received within 6 hours of ED arrival. Data presented were obtained by random chart review by the peer review agency. The statistical test used was the Fishers exact test with a significance level of 0.05.

**Results:** The number of records reviewed by the peer organization was 244 in 2008 and 200 in 2011. From 2008 to 2011, there was improvement on initial antibiotic selection for the immunocompetent non-ICU patient (97% vs.100%;  $p < 0.01$ ); there was improvement on initial antibiotic selection for the immunocompetent ICU patient (77% vs.100%;  $p < 0.001$ ); data also showed improvement in blood culture timing in ED before antibiotic was given (91% vs.100%;  $p < 0.001$ ). The administration of antibiotics within 6 hours of ED arrival improved but there was no statistical difference (99% vs.100%;  $p=0.5$ ).

**Conclusion:** Collaboration among members of the healthcare team including physicians, nurses and the pharmacist has resulted in 100% compliance for all of the emergency department specific pneumonia core measures.

5-087

**Category:** Emergency Medicine / Emergency Room

**Title:** Antimicrobial surveillance program by clinical pharmacists in the emergency department enhances treatment of urinary tract infections.

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**Purpose:** Symptoms of urinary tract infections (UTIs) are common presenting complaints of patients admitted to the emergency department (ED), with 150 million occurrences reported annually worldwide. Empiric antibiotic therapy for suspected UTI is often started in the ED without the benefit of urine culture results. Successful treatment depends on susceptibility of the organism to the antibiotic prescribed and patient compliance. This practice experience describes ED pharmacist antimicrobial surveillance activities in a community hospital setting, including review of culture and susceptibility reports, therapeutic recommendations and impact on patient care.

**Methods:** Northside Hospital is a 563-bed general medical and surgical hospital in Atlanta, Georgia. The Emergency Department serves patients in the north metro Atlanta community, with 51,133 visits annually. Dedicated ED clinical pharmacy services are provided ten hours each day with two pharmacists alternating weekly shifts. Culture and susceptibility reports obtained from the microbiology laboratory are reviewed daily by the clinical pharmacist. All positive and negative cultures for urine, blood, wounds, sputum and sexually transmitted diseases specimens are reported, as well as hepatitis/HIV profiles, fecal parasites, and rapid strep throat swabs. The ED pharmacist compares positive cultures with the previously prescribed antibiotic therapy from the patients medical record. If the antimicrobial therapy was found to be potentially inappropriate (organism was not susceptible or not tested for that antibiotic), the pharmacist collaborated with an ED prescriber to discuss alternative therapy. Patients were then contacted by the pharmacist and informed of the culture results and the proposed changes in antibiotic therapy. The new antibiotic prescription was phoned to the patients community pharmacy. This practice helped ensure that patients received optimal antimicrobial therapy for the organism causing the infection and hopefully prevented additional follow-up visits due to treatment failures. If a patient could not be reached by phone, a letter was sent to the patients home requesting they call back for additional information and treatment.

**Results:** In 2011-2012, 541 positive urine cultures were reviewed by the ED clinical pharmacists. Approximately 26% (143 patients) required intervention by the pharmacist. This included 102 patients who needed a change in antibiotic therapy and forty-one patients with

positive urine cultures who did not receive antibiotic prescriptions at discharge. The reasons for changes in antibiotic therapy included: eighty-one organisms resistant to the empiric antibiotic ordered, seven with intermediate susceptibility, and fourteen organisms that were not routinely tested for the antibiotic prescribed. Of 102 patients who required a change in therapy, 100% of pharmacist recommendations were accepted by the prescriber. The forty-one patients without discharge antibiotics were contacted by the pharmacist for antibiotic therapy or additional follow-up with a physician. Review of a single positive culture and documentation required approximately fifteen minutes. If the antibiotic therapy required a change, additional time was necessary. This process, which included culture review, prescriber consultation, patient contact and call to the community pharmacy required 30-45 minutes. All interventions were documented in the patients electronic medical record. Pharmacist analysis of 541 positive urine cultures (398 basic reviews and 143 interventions) saved a minimum of 170 hours of physician time.

**Conclusion:** The ED pharmacy antimicrobial surveillance program helped to improve patient care by identifying patients who required intervention and ensuring that they received appropriate therapy. In addition to saving physician time, this practice hopefully led to fewer return visits and treatment failures. Patients appreciated a personal telephone call that included follow-up by the pharmacist and allowed the patient to ask questions about changes in the treatment plan. The pharmacists recommendations were well accepted by prescribers and led to further development of this program. Data collected provided timely information to the ED staff regarding empiric treatment of infections, trends in prescribing patterns, and an ED antibiogram for the outpatient population. Future developments include evaluation of the addition of fosfomicin as a formulary agent and further analysis of ED clinical pharmacist services.

**5-088**

**Category:** Emergency Medicine / Emergency Room

**Title:** Implementation of pharmacy services to a free standing emergency department using on site pharmacist and remote support from a hospital pharmacy

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**Purpose:** Emergency room pharmacists have become valuable team members of hospital based emergency departments over the past several years. MultiCare Health System, an integrated non-profit health system based in Tacoma, WA, recently opened a 24/7 free standing emergency department at its Covington Campus. This report describes the establishment and implementation of pharmacy services to support a free standing emergency department (ED) using an on-site pharmacist and remote support, including tele-video, from a hospital pharmacy.

**Methods:** The planning committee wanted pharmacist support for the free standing ED and budgeted 1.2 FTEs for pharmacy (7 hours per day/7 days per week). An acute care manager and ED pharmacist specialist joined the planning committee. Pharmacist with the appropriate experience and skill level were recruited from MultiCares Level II trauma center. The pharmacist team had to develop a drug formulary and inventory levels, develop nursing staff IV admixture guideline reference book, ensure medication rooms and layout were appropriate, ensure appropriate stocking of med room and adult/pediatric crash carts and code boxes, and establish workflows and communication for effective support from pharmacists off site. A competency was developed and nursing staff were educated on aseptic technique, medication calculations and IV admixture. High-risk medications are required as a policy to be prepared under a pharmacist surveillance using high definition tele-video conferencing between Covington ED and remote site pharmacist. Interventions by on-site and remote site pharmacists were recorded to determine the activities and impact of pharmacy services. The ED staff also completed a survey measuring the degree of utilization of our ED pharmacist and the perception of the value and impact the on-site pharmacist have on quality of patient care.

**Results:** Information was collected from the initial opening date of the ED on April 3, 2012, to May 31, 2012. Pharmacists recorded a total of 568 interventions, which included but not limited to the following: formulary medication selection, optimizing cost-effective medication regimens, appropriate dosing, antimicrobial stewardship, drug information for physician and nurses, educating and assisting nurses on medication admixture, medication reconciliation, and patient education. Pharmacists also served an integral role on conscious sedation procedure and code team. The ED staff survey indicates that our pharmacy services are highly valued and many

recognized an improvement in medication safety due to the presence of an on-site pharmacist. Two examples where tele-video conferencing was used during this time period are IV admixture of heparin flush and vancomycin. Remote site pharmacists reported greater than ideal time spent on tele-video conferencing, although, the end result was accurate dispensing and prevention of medication error.

**Conclusion:** Pharmacy services in a 24/7 free-standing emergency room was successfully implemented using a combination on-site and remote site pharmacy support practice model. More education and training is required for nurses to learn tele-video and IV admixture. Pharmacists in the ED were well received by the ED staff due to an increase in overall support to the ED staff and improving the safety and quality of patient care.

**5-089**

**Category:** Emergency Medicine / Emergency Room

**Title:** Expansion of emergency medicine pharmacy services in a tertiary academic medical center

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**Purpose:** Despite recognition that the emergency department represents a high-risk medication use environment and publication of literature reports describing the utility of emergency department (ED) pharmacists with medication error interception, less than 10% of hospitals in the U.S. have a dedicated ED pharmacist. While provision of continuous 24-hour clinical pharmacy services in the ED may be ideal, financial constraints frequently necessitate that institutions optimize ED pharmacy services with limited resources. This report describes the strategic expansion of an emergency medicine pharmacy program and documented therapeutic interventions following implementation.

**Methods:** An ED pharmacy program was established in December 2010 consisting of dedicated pharmacist coverage from 0800 to 1630 on Monday through Friday in four ED nursing units of a tertiary academic medical center. Based on careful review of average hourly patient volumes in the ED, a rotating second-shift ED position was developed to ensure pharmacy coverage during peak patient hours. In February 2012, a second-shift ED position was officially added to expand overall pharmacy coverage to include the hours of 0700 to 2300 on Monday through Friday with weekend and holiday coverage from 1230 to 2300. Through creation of a three-hour shift overlap between the first and second shift ED pharmacists on weekdays, one of the ED pharmacists was able to complete non-direct patient care roles outside of the ED. Therapeutic interventions documented as I-Vents in the EPIC electronic medical record were analyzed and compared at three months pre- and post-program expansion.

**Results:** A total of 1491 interventions were documented in EPIC three months after program expansion in May 2012 compared to only 524 documented interventions three months prior to program expansion in November 2011. Of the 1491 documented interventions in May 2012, 22% were categorized as patient medication profile review for patients referred to the ED observation unit. Drug therapy recommendations represented 18% of the documented interventions while medication reconciliation constituted another 10% of interventions. Other intervention categories included medication order clarification (11%), allergy clarification (7%), enforcement of formulary restrictions (6%), and provision of drug information (4%). Of note, non-direct patient care functions such as pharmacy student didactics, educational in-service

development, and multidisciplinary meeting participation were not quantitatively captured in this EPIC I-Vent analysis.

**Conclusion:** Following expansion of an emergency medicine pharmacy program to include coverage during peak patient hours, a disproportionately large increase in documented therapeutic interventions was observed.

**5-090**

**Category:** Emergency Medicine / Emergency Room

**Title:** Impact of a clinical pharmacist on emergency medicine services

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**Purpose:** Medication safety in the emergency department (ED) is a unique challenge due to the high prevalence of verbal orders, predominate use of intravenous medications, and incomplete patient records that are associated with a higher risk of adverse events. Despite these risks, currently less than 4% of EDs have consistent pharmacist involvement in patient care. The purpose of this study was to design, implement and assess the impact of an emergency medicine clinical pharmacist pilot program on optimizing medication safety and efficacy and minimizing healthcare costs at St Elizabeth Health Center.

**Methods:** The institutional review board approved this prospective evaluation of clinical pharmacy services provided to patients in the ED of St. Elizabeth Health Center during the month of January 2009. A pharmacy resident was present in the ED during the peak hours of patient admissions to perform medication reconciliation and provide clinical pharmacy services to improve the safety and efficacy of drug therapy. Pharmacist performed medication reconciliation was compared to ED staff medication reconciliation for discrepancies (accuracy and/or completeness). The primary outcome is the number of medication reconciliation discrepancies avoided when performed by a pharmacist in the ED. Secondary outcomes include number and category of pharmacist interventions, recommendation acceptance rate, adverse drug events reported and prevented, cost savings, and the EDs perception of the value of an emergency medicine pharmacist. Physicians and nursing staff completed a survey before and after the pilot study to evaluate the perceived value of a clinical pharmacist in the ED.

**Results:** Medication reconciliation was completed on 71 patients with a total of 802 discrepancies avoided by the pharmacist. Avoided discrepancies included: 95 omitted medications, 8 extra medications, 213 omitted doses, 221 omitted frequencies, 243 omitted routes, 4 wrong medications, 6 wrong dosage forms, 3 wrong doses, and 9 omitted allergies. The pharmacists intervention recommendation acceptance rate was 95.7 percent. The top four interventions by number were drug information, initial antibiotic choice, initial dose calculation, and medication reconciliation, respectively. Total cost savings for the study period was 21,494 dollars. The perceived value of pharmacy services in the emergency department had improved according to the post survey.

**Conclusion:** Presence of a clinical pharmacist in the ED improved the accuracy and completeness of drug and allergy documentation during the medication reconciliation process. Pharmacy presence in the ED promoted safe medication use with an associated cost savings. Based on the information and results of this study 2 full time emergency medicine pharmacy specialist were hired and their presence in the ER has resulted in a total cost savings of more than 1,135,000 over 11 months.

**5-091**

**Category:** Emergency Medicine / Emergency Room

**Title:** Implementation and impact of 24 hour hospital pharmacy services and emergency department clinical services: a combined role.

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**Purpose:** Community hospital pharmacy departments face unique but multifaceted staffing challenges. Recent Joint Commission standards requiring prospective medication order review have further complicated these issues. This project describes how implementing 24 hour on site pharmacist coverage in the emergency department (ED) can be an effective and viable option to meet these standards. In addition, 24 hour pharmacy services positively impact patient care and non-pharmacy hospital staff.

**Methods:** In order to offer the best patient care, it was decided that a night pharmacist position would be added to provide 24 hour pharmacy services. Due to the high number of patients admitted through the emergency department, it was determined that placing the night pharmacist (responsible for hospital wide services) in the ED would increase productivity and continuity of care. After the introduction of the night pharmacist position, it was requested by ED staff that pharmacy services be present in the emergency department at all times. In response to this request, pharmacy services were expanded to cover 20 out of 24 hours in the ED. Information was then collected regarding pharmacists productivity and the fiscal impact of the new staffing strategy. Additionally, an anonymous survey was performed to gather the opinions of non-pharmacy hospital staff.

**Results:** From October 2010 through December 2011, the emergency department pharmacists documented 10,875 interventions resulting in a calculated value of \$2,544,456. After the introduction of ED pharmacy services, the amount of ED dispensed (24 hour supply) medications sent home with patients decreased significantly with an estimated savings of \$11298.72 annually. Physician and nurse survey results showed that the pharmacists were considered an integral and appreciated part of the medical team. According to non-pharmacy hospital staff, patient quality of care was greatly improved and job satisfaction was significantly increased.

**Conclusion:** The implementation of the additional overnight and ED combined pharmacy services has been well received by the hospital staff. Due to pharmacist conducted medication histories, medication compounding and the current prospective/retrospective order review processes, patient safety has improved and Joint Commission standards have been met.

Additional improvements include cost decreases and an increase in hospital staff job satisfaction. Expanding pharmacist responsibilities while combining job roles can be one way solve staffing difficulties in a small hospital.

5-092

**Category:** General Clinical Practice

**Title:** Impact of a pharmacist-driven discharge counseling program in a community hospital setting

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**Purpose:** Too often hospitalized patients lack a complete understanding of the complex medication regimens they receive. Medication changes and additions occurring frequently within the hospital are accompanied by brief explanations where side effects are not always discussed. To substitute counseling, medication handouts are often given to patients which tend to compound the issue as they can offer information that is misleading, inadequate, or too generalized for the individual patient. Ultimately, patients are incompletely informed and may leave the hospital feeling confused. A pharmacist-driven discharge counseling program was implemented to increase overall patient understanding of their medications, Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) results, and awareness of the pharmacists presence within the hospital. An illustration of these successes may further demonstrate the effectiveness of continuing such a program within the hospital setting.

**Methods:** Every weekday a designated staff pharmacist was faxed a schedule of the patients anticipated to be discharged home that day. Time permitting, a designated pharmacist, clinical pharmacist, and Advanced Pharmacy Practice Experience (APPE) students would counsel as many patients as possible. The educator would review the patient chart and educate the patient on scheduled medications including indication and the most common side effects associated with each respective medication. During each encounter, time was reserved to answer any questions the patient may have had and the pharmacy phone number was left with the patient to call should other questions arise. All patients were tracked and information was gathered from the patient based on their response to counseling.

**Results:** In one month, 64 patients were counseled by a pharmacist or pharmacy student. A goal of this program was to improve communication about medications to patients as assessed by their feedback and verbalization of understanding. On average the educator spent twenty minutes with each patient. All patients who were approached accepted counseling and most expressed an appreciation for the time spent discussing medications. Patients were highly receptive to the counseling as they asked questions and reported increased understanding of their past, current, and new medications. Errors were found that might have gone by unnoticed had the medication review not occurred.

**Conclusion:** A pharmacist-driven discharge education program at Summa Western Reserve Hospital heightened understanding of medication indications and side effects by patients in the hospital and upon their discharge home. A majority of patients expressed gratitude and appreciated the time taken by the pharmacy to discuss their medications with them. This program increased awareness of the role of a pharmacist in the hospital and justifies the need for a increased pharmacist-patient interaction on a full-time basis. Due to these successes, the pharmacist-driven discharge counseling program will be continued as a service provided by the pharmacy at Summa Western Reserve Hospital to home-going patients.

5-093

**Category:** General Clinical Practice

**Title:** Impact of a residency antimicrobial stewardship rotation on pharmacist initiated interventions

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**Purpose:** A community hospital beginning a new post graduate year one pharmacy residency program sought to expand its pilot antimicrobial stewardship program (ASP). The goal of the pharmacy department was to provide an elective ASP rotation for the residents pursuing more advanced training in the area of infectious diseases (ID) while increasing antimicrobial interventions within the institution. Anticipated benefits of the rotation were to improve antimicrobial stewardship in accordance with the 2007 Infectious Diseases Society of America's program development guidelines through pharmacist prospective audit and feedback.

**Methods:** The ASP rotation preceptor developed the syllabi for the rotation based on the Society of Infectious Diseases Pharmacists antibiotic stewardship certificate program's learning objectives. Topics for the two month elective rotation included: microbiology, pharmacology, pharmacokinetics and pharmacodynamics, disease states and treatments, interventions, and infection control. Specific information within each learning objective topic was tailored based on the residents' learning needs. Patient centered care was accomplished through prospective audit and feedback of specified patients in the ASP program. As part of the audit and feedback process, the residents discussed higher acuity patients with the ID physician during sit down rounds. The residents also focused on implementing pharmacist driven antibiotic services such as renal dosing and intravenous (IV) to oral (PO) conversions within the institution. The number and rate of acceptance of resident antimicrobial interventions were compared to the staff antimicrobial interventions during the time of the ASP rotation. All antimicrobial interventions were included and categorized as the following: renal dosing, IV to PO conversions, antimicrobial discontinuation, antibiotic change based on culture and sensitivity, dose optimization, and other antimicrobial interventions. Pharmacist managed pharmacokinetic dosing interventions were excluded since it is a consult driven service.

**Results:** During the two month time frame, two pharmacy residents intervened on antimicrobials 99 times, and seven of the staff pharmacists intervened on antimicrobials 49 times. The residents' interventions resulted in a 102 percent increase in antimicrobial interventions when compared with the staff pharmacists. The residents had 80 interventions (81 percent) accepted while the staff pharmacists had 44 interventions (90 percent) accepted.

**Conclusion:** Dedicated pharmacy residents for a community hospital ASP resulted in increased antimicrobial interventions.

**5-094**

**Category:** General Clinical Practice

**Title:** Reduction of alvimopan use by implementing a restriction protocol in a community hospital

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**Purpose:** Alvimopan (Entereg) is a peripheral opioid receptor antagonist indicated for prevention of post-operative ileus in patients undergoing bowel resection surgery with primary anastomosis. It is proposed to reduce hospital length of stay (LOS) by accelerating the return of normal bowel function in these patients. Due to safety concerns and limited efficacy data, this medication was added on the hospital formulary with strict prescribing criteria that were detailed in a physician order form. A follow-up review was performed that revealed that the use of this medication did not improve the time to bowel recovery or LOS especially when it was used in patients undergoing laparoscopic procedure. Based on these results, the Pharmacy and Therapeutics (P&T) Committee further restricted alvimopan for patients undergoing open bowel resection surgery with primary anastomosis. The purpose of this IRB reviewed study was to reduce alvimopan use by implementing prescribing restrictions and decreasing its use in laparoscopic procedures.

**Methods:** Colorectal surgeons and surgery pharmacists and nurses were educated on the P&T restrictions for alvimopan use in open procedures only. Date of implementation for new restrictions was March 2012. Pre-operatively, all patients undergoing bowel resection surgery could receive a dose of alvimopan. An automatic stop order by the pharmacist was allowed for all post-op alvimopan orders for laparoscopic procedures. Data collected included number of doses dispensed and amount spent on alvimopan pre and post implementation.

**Results:** The average number of doses dispensed for December 2011 February 2012 (pre-implementation period) was 66 per month. On the other hand, during March May 2012 (post implementation period) on an average 36 doses were dispensed per month. Furthermore, alvimopan prescribing restrictions resulted in a savings of ~ \$7,750.00 over the three month period.

**Conclusion:** Implementation of prescribing restrictions is effective in curtailing alvimopan use. It helped reduce alvimopan use by 45% over the study period.

**5-095**

**Category:** General Clinical Practice

**Title:** Competing priorities in a community hospital emergency department: what's a newly deployed, rotating pharmacist to do?

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**Purpose:** Numerous studies have proven the benefit and impact a pharmacist can have in a hospital emergency department. The specialty residencies available to pharmacists have provided further opportunities to advance patient care. Not all hospitals have a specially trained pharmacist available in the ED, but there are still opportunities to make positive interventions. This project was designed to implement a new position in a semi-rural, community hospital that rotates all of the clinical pharmacists through the ED.

**Methods:** The initial step to implement the new position involved outlining responsibilities of the ED pharmacist. This was completed in several ways. First, a literature search was conducted to identify current practice modalities. Second, small groups of pharmacists shadowed ED pharmacists at 5 other hospitals. Third, system policies and procedures were reviewed as this hospital is part of a larger system. Fourth, a survey was given to current ED staff to gather their input. A list of potential interventions was generated from these steps and two primary objectives were selected for the ED pharmacists initial focus. A number of secondary goals were also identified. Next, the hours for the ED shift were determined. The hours were correlated with a high volume of patients admitted to the hospital through the ED. A daily report was generated that detailed admission times to facilitate this decision. Finally, retrospective chart reviews and audits were completed to measure the impact the clinical pharmacists had on the two primary objectives.

**Results:** Based on the background research and in-house surveys, the two initial priorities selected for pharmacists focus were to improve accuracy and completeness of medication reconciliation for patients admitted to the hospital through the ED and to decrease order verification turn around times. The pharmacists performed many duties while staffing in the ED (ex. provided drug information and antimicrobial stewardship, performed pharmacokinetic and anticoagulation consults, facilitated error reporting, and managed drug shortages) but concentrated much of their effort on the two primary goals. Using a daily report that detailed times patients were admitted through the ED the previous day, two months of data were gathered to show that 51% of patients had an admission disposition selected between the hours of 1100 and 1900. Since this 8 hour time period covered over half of the daily admissions, this was the shift time selected for the deployed pharmacist. A pharmacist staffed these hours Monday through Friday. The retrospective chart review showed that a pharmacist reviewed 87.1%

(196/225) of the medication reconciliations for patients admitted between 1100 and 1900 Monday through Friday over the course of 6 weeks. Pharmacists intervened on 76% (149/196) of the medication reconciliations reviewed. Prior to deployment in the ED, average ED order verification time was 5 minutes. The first month after the new position was staffed, the average time increased to 7.8 minutes. It then declined over the next month to 4.8 minutes.

**Conclusion:** Despite the lack of formal residency training, the clinical pharmacists at this semi-rural, community hospital were able to make a positive impact on practice in the ED after careful research and preparation. The accuracy and completeness of medication reconciliation improved drastically with pharmacist intervention. Initially, the order verification turn around time increased as the pharmacists adjusted to the new practice environment and responsibilities but improved as time went on. The initiation of this deployed position has been an overall success and has opened many opportunities for future interventions.

**5-096**

**Category:** General Clinical Practice

**Title:** Situational analysis of the vancomycin use monitoring procedure

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**Purpose:** To evaluate whether Vancomycin serum levels monitoring was appropriate in our institution, taking the IDSA/ASHP guideline as a parameter.

**Methods:** The study was performed in a private three hundred sixty bed private hospital focused mostly on oncology and surgical patients. During February and March 2012 patients housed in four adult and one pediatric intensive care units and a bone marrow transplant unit receiving vancomycin were followed by the clinical pharmacists. The following parameters were analysed: a) if the prescribed dose was in accordance with patients weight; b) if the first Vancomycin serum level was measured after the steady state (before the 4th or following doses); c) if the blood collection was made during the hour preceding the next administration; d) if the Vancomycin serum concentration was within the desired therapeutic range (15 20 mcg/ml).

**Results:** Forty-four patients were followed: thyrth-five adults and nine pediatric patients. The average treatment duration was of 11.2 7.1 days. The prescribed dose was not adjusted to body weight in twenty-two patients. In twenty-four patients vancomycin levels were measured before the steady state was reached. In the intensive care units problems were found regarding the time of Vancomycin serum levels collection in fifteen patients. Vancomycin serum concentrations under the goal range were detected in thirty-five cases; of these, seven samples were collected before the steady state, one sample was from a patient in whom the dosing was not weight adjusted and in four samples no deviation was found.

**Conclusion:** From this data collection we conclude that the Vancomycin serum level monitoring is not done in a proper way at the institution. Although physicians may know theoretically the principles of vancomycin dose monitoring, laboratory blood collection routines and modifications in infusion timing due to complex routines typical of critical patients impact negatively in the precision of this practice. This study data indicate the need of elaborating an institutional clinical protocol for a more precise monitoring of vancomycin levels.

5-097

**Category:** General Clinical Practice

**Title:** Problem based learning in an elective course to associate treatment principles between acute and ambulatory patient care

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**Purpose:** Describe the effectiveness of the pharmacotherapy elective in preparing students for participation in both acute and chronic patient care during their advanced pharmacy practice experience (APPE) rotations and their perception regarding the value of the course.

**Methods:** Pharmacotherapy: A Case-Based Elective was added to the ninth quarter of the South University accelerated curriculum introducing students to the concept of transitioning patients between acute and ambulatory care concepts before beginning their advanced practice rotations. The course utilized a problem based learning (PBL) format with the class divided into small groups of four working as a team throughout the quarter. A progressive patient case format was used allowing students to identify differences in pharmacotherapy associating acute and chronic patient care. The cases were developed with the patient as either an inpatient or outpatient with transition to the opposite setting in the next case. A problem list was created with each case to either introduce new topics or expand on those already presented within the curriculum. The course design allowed students to identify learning issues as the case progressed as well as encouraged critical thinking skills. Additional requirements for the course included a journal club presentation and preparation of a drug monograph. On the last day of the course a paper-based survey was distributed to the students. The survey consisted of ten questions related to the structure and content of the course and returned to an impartial third party. A 5-point Likert scale allowed students to rank their level of agreement with each question. Additional data collected included gender, age, highest degree earned and plan to pursue post-graduation training. Descriptive statistics will be used to evaluate all data.

**Results:** Forty students were enrolled in the course over a two year period. The following are a sample of survey questions with median results. I learned new pharmacotherapy content, median 4.3. Topics covered were unique, median 4.1. Topics more in-depth, median 4.1. Greater interest in incorporating clinical activities in pharmacy practice, median 4.3. Recommend course, median 4.6. PBL format helped in course, median 4.5. Format helped in understanding pharmacotherapy concepts, median 4.4. Content will assist with APPE rotations, median 4.8.

**Conclusion:** Students overall perception of the course was that the content and format were original, and did contribute to preparation for APPE rotations across different clinical sites.

Utilizing PBL within the elective course enhanced students clinical knowledge and skill set development.

**5-098**

**Category:** General Clinical Practice

**Title:** Utilization of Automatic Stop Order Practice Among Academic Medical Centers

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**Purpose:** Utilization of automatic stop orders (ASO) in the institutional settings are controversial. Some believe that such enforcement may cause unnecessary hindrance to patient care while others believe that the process leads to rationale medication usage. We conducted a survey among academic medical centers to identify the practice among the academic medical centers.

**Methods:** A questionnaire on current automatic stop order practice including antimicrobials, controlled substances, ketorolac, anticoagulants, compounded intravenous drugs and TPN was sent electronically to 89 University Health Consortium members and they were also asked to identify any other agents covered under ASO policy.

**Results:** Eighty nine percent of the respondents (39/44) had ASO policies in place. Pharmacists monitored prophylactic, empiric and therapeutic antimicrobial use in seven (18%) hospitals with the absence of any formal policy. The antimicrobial ASO policies limited prophylactic use to maximum one day in 48% hospitals, empiric use ranged from 3-30 days in 51% of the hospitals. Three institutions had Vancomycin usage limited to seven days with the absence of any formal policy on other antimicrobial use. Controlled substance usage policies ranged from 3-60 days in 77% of the hospitals. Ketorolac use was limited to 5 days in 64% of hospitals. Other usage ranged from 1-15 days in 26% hospitals. Intravenous anticoagulant use was limited to one day in 8%, 5 days in 15% institutions. Oral and subcutaneous anticoagulant use ranged from 1 60 days in 72% hospitals. Pharmacist monitored all anticoagulant use in 15% institutions with the absence of any formal ASO policy on anticoagulant use. ASO policies for compounded non-controlled intravenous solutions ranged from 1-14 days in 31% hospitals. 21% of the hospitals limited TPN use to one day. ASO policy included propofol, dexmetedomidine in few institutions.

**Conclusion:** Our results demonstrate that ASO policies are used in many institutions and the practices are highly variable. Antimicrobials, anticoagulants, and controlled substances are commonly included in the ASO policies. Pharmacists monitor antimicrobials and anticoagulants use with the absence of formal ASO policies in some hospitals.

**5-099**

**Category:** General Clinical Practice

**Title:** Pharmacists impact on decreasing length of stay in a collaborative care unit

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**Purpose:** A multidisciplinary team was created to identify barriers and implement solutions to decrease length of stay (LOS), increase patient satisfaction, improve quality care and reduce costs to the patient and organization on a Collaborative Care unit. The hospital chose to pilot Collaborative Care on a telemetry unit, mainly comprised of internal medicine patients. The average LOS for this particular unit during the first quarter of 2011 was 3.76 days. Patient satisfaction is also an important component of quality care and is measured by hospitals as well as Centers for Medicare and Medicaid Services. The survey utilized is the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS). Results of this survey get reported to CMS and reimbursement is based on performance. The average HCAHPS score for communication about medication during the first quarter of 2011 was 54.

**Methods:** The collaborative care team which is comprised of a nurse, physician, clinical pharmacist, care facilitator, unit manager and other ancillary departments work together from admission to discharge to ensure safe, effective and affordable care. Standard work was created for each care provider to minimize waste and duplication of roles. Each member of the team has equal input into the patient plan. The clinical pharmacists daily responsibilities include: medication reconciliation on admission and discharge, patient counseling, renal dose adjustments, IV to oral conversions, antimicrobial stewardship, anticoagulation monitoring/dosing and pharmacokinetic dosing.

**Results:** After implementation of collaborative care, the average LOS decreased to 3.33 days for the first quarter of 2012. The HCAHPS score for communication about medication remained unchanged at 53.

**Conclusion:** Integration of pharmacy services into a collaborative interdisciplinary team allows the pharmacist to directly impact medication therapy decisions at the point of prescribing and helped lead to a decrease in LOS. The HCAHPS score remaining unchanged even after implementation of a clinical pharmacist rounding on each patient demonstrated that additional changes needed to be made. A standardized key-word script is being developed and implemented for pharmacist-patient medication encounters.

**Category:** General Clinical Practice

**Title:** Darbepoetin alfa protocol implementation in an inpatient rehabilitation hospital: the pharmacist's impact

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**Purpose:** Erythropoietin stimulating agents (ESAs) such as darbepoetin alfa (DARB) play a major role in the management of anemia due to chronic renal failure (CRF). However, due to the increasing evidence of serious life threatening adverse events associated with ESAs, strategies were recommended by ESAs manufacturers and the Food and Drug Administration (FDA) to enhance their efficacy and reduce harm. Some of these recommendations in CRF patients are to use the lowest dose needed to avoid blood transfusion, maintain hemoglobin (Hgb) between 10-11g/dL, and to ensure adequate iron storage and saturations before and during ESAs use. These have been proven to help achieve target Hgb levels, decrease ESA utilization, and decrease adverse events associated with its use. The purpose of this retrospective review is to assess the pharmacist's impact on implementation of DARB protocol based on key clinical and economic indicators monitored.

**Methods:** DARB use at our institution is primarily for the management of anemia in CRF patients however it has inappropriately been prescribed for indications such as post-operative anemia and anemia of unknown origin. For this retrospective review the data was collected for baseline period (Jan-Dec 2008), phase 1 (Jan-Dec 2009), phase 2 (Jan-Dec 2010), and phase 3 (Jan-Dec 2011). During the baseline period DARB use and management was primarily physician driven with minimal pharmacist involvement. During phase 1 the protocol was developed and approved by pharmacy and therapeutics committee; physicians and pharmacists were educated. However the protocol was not in full swing until phase 2. During phase 3, protocol compliance was entirely driven by pharmacists in coordination with physicians. The primary outcome evaluated was the optimal use of DARB based on appropriate indications, dose, iron studies, and attaining or maintaining target Hgb levels (10-11 g/dL). Secondary outcomes included number of DARB doses dispensed, amount of iron supplementation used (intravenously or orally), and the number of pharmacist interventions. The study outcomes were compared between the four periods.

**Results:** Appropriate use of DARB was 45% (baseline), 63% (phase 1), 57% (phase 2), and 95% (phase 3). The average DARB dose was significantly less in Phase 3 (60mcg) compared to baseline (160mcg). Phase 1 and 2 had similar dose average (100mcg). The protocol implementation led to the discontinuation of DARB 200mcg dose altogether, although the utilization of intravenous (IV) iron doubled in phase 2 and 3 compared to baseline period; phase

1 had minimal increase in IV iron use. Appropriate iron study lab orders before and after DARB initiation was 9% (baseline), 24% (phase 1), 94% (phase 2), and 100% (phase 3). The total number of DARB doses dispensed per 1,000 patient days were 3.67 units (baseline), 2.38 units (phase 1), 2.04 units (phase 2), and 1.57 (phase 3). About 33% (baseline), 42% (phase 1), 59% (phase 2), and 67% (phase 3) of patients had Hgb between 10-12 g/dL. The number of pharmacists intervention on DARB increased significantly from pre-protocol implementation to date. Total costs avoided due to pharmacist interventions were \$0 (baseline), \$8,568 (phase 1), \$18,784 (phase 2), and \$15,822 (phase 3).

**Conclusion:** The optimal use of DARB entails appropriate indication, dosing, lab ordering and monitoring in patients prescribed DARB. These were attained when DARB protocol was implemented and a superior outcome was seen when the protocol was driven entirely by pharmacists.

**5-101**

**Category:** General Clinical Practice

**Title:** A pilot of pharmacist counseling patient on new medications prior to discharge in a 154-bed community hospital

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**Purpose:** National Research Corporation (NRC) Pickers Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) program is a standardized survey of hospital patients that captures patients unique perspectives on hospital care for the purpose of providing the public with comparable information on hospital quality. This survey contains several medication related questions such as whether someone on the hospital staff explained the purpose and possible side effects of new medicines to patients. At St. Lukes The Woodlands Hospital, a 154-bed community hospital with 22 ICU beds located in Houston suburban area, we identified opportunities to improve the survey scores on medication related questions in the HCAHPS program. The purpose of this project is to pilot a pharmacist counseling program focusing on patients new medications prior to discharge.

**Methods:** The project was implemented in 3A unit, a 29-bed medical/surgical floor, during a two-week time frame (weekdays only) in February 2012. Inclusion criteria were patients who were discharged home and whose discharge prescriptions contained new medications. Exclusion criteria were patients who were discharged to long term acute care facility or nursing homes. Pharmacists utilized AIDET (Acknowledge-Introduce-Duration-Explanation-Thank You) technique to communicate with patients. The focus of pharmacist counseling was the indications and side effects of patients new medications. At the end of the counseling session, patient was asked to complete a short satisfaction survey. The results of the survey were compiled, and descriptive statistics were reported.

**Results:** During the two-week pilot, eighteen patients were counseled by pharmacists (1-4 patient per day), and twelve surveys were collected. According to the surveys, 92% of patients found the medication information presented by pharmacists was helpful or useful, 92% understood what their new medications were for, and 92% understood the side effects of their new medications. On the HCAHPS question of staff explained what medicine was for, 90% of 3A unit patients answered always at the end of February compared with 71% a month ago.

**Conclusion:** This small pilot demonstrated that pharmacist counseling on patients medications can be an effective approach in improving hospital quality measurement such as HCAHPS program.

**Category:** General Clinical Practice

**Title:** Evaluation of the 4Ts clinical pre-test scoring system for the diagnosis of heparin-induced thrombocytopenia in a community teaching hospital.

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**Purpose:** Heparin-induced thrombocytopenia (HIT) is a serious prothrombotic adverse drug reaction caused by heparin. This reaction is due to an immune-mediated response to platelet factor 4 (PF4) heparin complex formation in patients who are receiving unfractionated heparin (UFH) or low-molecular-weight heparin (LMWH). At our institution there is no formalized process for initiating an evaluation for heparin-induced thrombocytopenia. Clinicians may request heparin antibody test based on their clinical judgment, often looking at decreasing platelet count regardless of other potential causes. Based on institutional guidelines, patients with positive polyspecific enzyme-linked immunosorbent assay (ELISA) with optical densities (O.D) of greater than or equal to 0.4 will automatically have a serotonin release assay (SRA) ordered. A negative ELISA result is an excellent test for ruling out HIT. A positive, ELISA as well as positive SRA increases the probability of clinical HIT and is an indication for treatment of with argatroban, a direct thrombin inhibitor at our institution. Seventeen patients received argatroban therapy for the presumptive treatment of HIT over a 2-year period and only 2 patients had positive ELISA and SRA results. The 4Ts clinical pre-test scoring system is a validated objective reproducible tool for assessing the clinical probability of HIT and the need for laboratory testing. Calculation of the 4Ts score involves evaluating the extent of thrombocytopenia, timing of the patients platelet decline, presence of thrombosis or other sequelae, and consideration of alternative causes of thrombocytopenia. Pretest probability of HIT ranges from 0 to 8 with the following probability classifications: 0-3 (low), 4-5 (intermediate) and 6-8 (high). We conducted this study to analyze the utility of the 4Ts scoring system as a predictor for the detection of heparin induced thrombocytopenia in our community teaching hospital.

**Methods:** An electronic database was used to identify patients who had an ELISA performed for HIT evaluation between May 1, 2010 and May 31, 2012 at our 240 bed community teaching hospital. Information collected included the following: Age, gender, weight, height, previous allergy history, past medical history, type of heparin, quantity of heparin exposure, concurrent medications, and co-morbid conditions that may contribute to the diagnosis of thrombocytopenia. Patients who did not receive anticoagulant therapy but were recently

hospitalized or were in a nursing home over the past 30 days and were exposed to heparin products during their stay, or who received heparin flushes during their outpatient hemodialysis procedures were included in the study. A list of alternative causes of thrombocytopenia that were considered when calculating the 4Ts scores was developed based on previously published literature. Alternative causes had to have a temporal relationship to the onset of thrombocytopenia and demonstrate consistent clinical patterns as described in the literature. The 4Ts scores were calculated by four independent investigators as well a Doctor of pharmacy candidate. Discrepancies in 4Ts scores were adjudicated in a meeting between all five evaluators.

**Results:** Three hundred and twenty-four ELISA results were evaluated using the 4Ts scoring system, of which 251 (77.5 percent) ELISA results were negative based on O.D. of less than 0.4. Of the 73 (22.5 percent) with positive ELISA results, 2 (0.62 percent) were SRA positive while 3 (0.93 percent) were borderline SRA positive. Based on the 4Ts score 136 (42 percent) were classified as low risk, 130 (40 percent) were classified as intermediate risk and 59 (18 percent) were considered high risk. Of the low risk patients 12 (9 percent) patients had positive ELISA results, one patient who received heparin flushes during hemodialysis with a 4Ts score of 2, O.D.=0.927 by ELISA was borderline SRA positive. The mean optical density for the low risk patients was 0.267 with a standard deviation of 0.144 and range of 0.047 to 1.097. Anticoagulant therapies implicated in thrombocytopenia in these patients were: enoxaparin in 40 patients, UFH in 51 patients, and fondaparinux in 3 patients. Forty-seven low risk patients were not on any anticoagulant therapy during hospitalization. Majority (62) of the low risk patients received prophylactic doses of their respective agent, 6 received treatment doses, 19 received heparin flushes. Of the intermediate risk patients, 39 (30 percent) patients had positive ELISA results with mean optical densities of 0.364, standard deviation of 0.312 and range of 0.047 to 2.507. One patient who was exposed to UFH in the nursing home at prophylactic doses had a borderline SRA (4T score =4, O.D.=0.519), and one patient who received UFH heparin at prophylactic doses had a positive SRA (4T score =4, O.D.=2.407). Forty-one intermediate risk patients received enoxaparin therapy, 72 received heparin therapy, 7 received fondaparinux therapy and 25 did not receive any anticoagulant therapy during hospitalization. In the intermediate risk patients who received therapy 75 received prophylactic doses, 17 received treatment doses and 16 received heparin flushes. Of the high-risk patients, 17 (29 percent) had positive ELISA results with a mean of 0.384 with a standard deviation of 0.281 and range of 0.082 to 1.661. One patient receiving prophylactic doses of heparin had borderline SRA (4T score =8, O.D.=0.833) and one had a positive SRA (4T score=6, O.D.=0.767), this patient received heparin flushes during hemodialysis. Nineteen high-risk patients received enoxaparin therapy, 40 received heparin therapy, 1 received fondaparinux therapy and 4 did not receive any anticoagulant therapy during hospitalization. In the high-risk patients receiving therapy, there were 44 who received prophylactic doses, 6 received treatment doses and 4 received heparin flushes. In looking at the percent platelet drop between the different risk groups, 29 (21.3 percent) low risk, 20 (15.4 percent) intermediate risk and 2 (3.4 percent) high risk patients had at least a 30 percent drop in their platelet count. Further analysis revealed that 10 (7.4 percent) low risk, 72 (55.4 percent) intermediate risk and 55 (93.2 percent) high risk patients had at least a 50 percent drop in their platelet count. The majority (71.3percent) of the low risk patients did not have a significant drop in their platelet count compared to only 38 (29.2 percent) and 2 (3.4 percent) of the intermediate risk and high risk score patients respectively. Seventeen patients received argatroban therapy for the treatment of presumptive HIT. Of which 5 patients had an O.D. of greater than or equal to

0.4, one of which had a borderline positive SRA. Average number of days on argatroban was 4 days (range 3 to 8 days). Twelve (70.5 percent) of the patients received argatroban despite an O.D. of less than 0.4.

**Conclusion:** The overall prevalence rate of HIT based on an O.D. of greater than or equal to 0.4 by ELISA and positive serotonin release assay was 0.62 percent and 0.93percent for borderline positive SRA. A significant number of ELISA test were ordered in patients who are very low risk for HIT especially those who did have the premier clinical sign of HIT (at least a 30 percent drop in platelet count). Additionally argatroban therapy was initiated and continued in patients who were not at risk for HIT based on negative ELISA tests. The use of the 4T clinical pre-test scoring system will significantly reduce the ordering of inappropriate ELISA testing as well guide clinicians in their treatment of presumptive and definitive HIT.

**5-103**

**Category:** General Clinical Practice

**Title:** Implementation of a medication reconciliation process in a community teaching hospital: a pilot study focused on patients at high risk for hospital readmission.

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**Purpose:** The joint commission national patient safety goal (NPSG) 03.06.01 requires that health care organizations maintain and communicate accurate medication information to their patients. This is accomplished by conducting medication history, comparing medication information that the patient brought to the hospital with medications that is prescribed during hospitalization in order to identify and resolve discrepancies, providing patients with written information on the medications the patient should be taking when discharged from the hospital and explaining the importance of managing medication information to the patient upon discharge from the hospital. Discrepancies are defined as duplications, omissions, contraindications, unclear information and changes. In order to address the NPSG 03.06.01 requirements our institution through a multidisciplinary team developed a comprehensive medication reconciliation process. Within 24 hours of admission, the patients nurse will obtain a medication history and enter the list of medication into the computer. The pharmacist will compare the list of home medications entered in the Meditech computer program by the nurse to the admission medication orders written by the physician and notify the prescriber of any discrepancies identified. Prior to discharge, the physician will compare the home medication list, medication prescribed during hospitalization, and the discharge medications and reconcile any discrepancies. Discharge medication education is conducted by the patients nurse who provides the patient with a comprehensive list of their discharge medication as well as other instructions for post-hospitalization care. We conducted this study to determine our institutional compliance to the medication reconciliation process, describe the type of discrepancies identified at medication reconciliation and document any challenges encountered during the implementation phase of this process. Patients at high risk for readmissions were targeted for the implementation phase of this process because our institution recently implemented a comprehensive individualized case management program targeting this population

**Methods:** Patients at high risk for readmission to the hospital within 30 days of discharge were identified on a daily basis by the case management department. Within 24 to 48 hours of admission, a pharmacist or a final year pharmacy student reviewed the patients admission medication list on Meditech computer system and compared it the medication prescribed to the patient on admission. Patients were followed through out their hospital stay. On discharge, the pharmacist or pharmacy student compared their home medication, hospital medications and

discharge medications. Discrepancies were categorized as appropriate discrepancies or inappropriate discrepancies based on their potential to cause harm to the patient. Appropriate discrepancies are those not likely to cause harm such as appropriate dose or medication change, appropriate omission, formulary based changes, discontinuation of therapy due to major drug interactions, non indication for home medications, or appropriate new medication on admission. Inappropriate discrepancies are those that have potential to cause harm and include: differences in home medication list compared to medications prescribed on admission; unknown reason for change in home medication; unknown omission of home medications

**Results:** Forty-three high risk patients were included in this study. Twenty-four (55.8 percent) were females and 19 (44.2 percent) were males. The patients took an average of 8.9 medications prior to admission. Forty-one (95.3 percent) of the patients had discrepancies for a total of 509 discrepancies identified at the time of admission. 365 (71.7 percent) of the discrepancies were appropriately prescribed new medications on admission, while 144 (28.3 percent) involved medications that the patients were taking prior to admission for an average of 3.35 discrepancies per study patient. Of the 144 discrepancies, 91 (63.2 percent) were considered appropriate discrepancies. Frequently identified appropriate discrepancies include appropriate omission (36.1 percent), appropriate medication change (9.8 percent), dosage change (10.4 percent) and formulary related changes (6.9 percent). Fifty-three (36.8 percent) were considered inappropriate discrepancies. Frequently identified inappropriate discrepancies include unknown omission of home medication (20.8 percent), unknown changes in the dosage regimen of home medications (7.7 percent), and continuation of a home medication with no apparent indication (7.6 percent). Forty-three (81.1 percent) of the 53 inappropriate discrepancies were addressed through pharmacist consultation with the prescriber while 10 were not appropriately addressed. Thirty-eight patients were followed through discharge. Five patient medical records could not be reviewed on discharge because 1 died and 4 patients had no discharge medication list in their medical records. These patients were discharged on an average of 10.5 medications per patient. The discharge medication reconciliation revealed 285 discrepancies, of which 210 (73.7 percent) for appropriate addition of new medications while seventy-five (26.3 percent) were inappropriate discrepancies. Most (90%) of the inappropriate discrepancies were inappropriate continuation of home medications without apparent indications, inappropriate continuation of new therapy when no indication exists, and inappropriate continuation of a drug changed due to formulary availability. Most often implicated classes of medication involved in these discrepancies include cardiovascular agents (33 percent), electrolytes and vitamins (17 percent), Acid suppressants and bowel regimens (16 percent), HMG-CoA reductase inhibitors (10 percent), respiratory agents (10 percent), Insulin (8 percent), HIV medications (4 percent). Pharmacists did not have a role in discharge medication reconciliation, hence were unable consult on these discrepancies.

**Conclusion:** Approximately 37 percent of all admission discrepancies had a potential to cause harm to the patient. Pharmacists were able to identify and resolve medication discrepancies during hospital admission, but were unable to assist in resolution of medication discrepancies on discharge. An important outcome of this study was the modification of the medication reconciliation workflow within the pharmacy. Less than 10 percent of patients medication lists were available on the computer at the time the pharmacist processed the admission orders, approximately 60 percent of the patients had medication list in the computer within 24 hours admission and 85 percent of patients medication list were available within 48 hours of

admission. . Pharmacists will continue to attempt to perform medication reconciliation when processing the admission orders. This activity became a primary responsibility of the clinical pharmacist who performs medication reconciliation on new admissions by generating a list all patients admitted to their respective patient care areas every 24 hours, and 48 hours.

**5-104**

**Category:** General Clinical Practice

**Title:** Impact of the pharmacist in the patient-centered medical home

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**Purpose:** The patient-centered medical home (PCMH) model is an established health care delivery method that emphasizes patient-centered, multidisciplinary care coordinated by the primary care provider. Integration of the pharmacist in the PCMH is widely acknowledged as beneficial, however; pharmacist value in this model has not been clearly demonstrated. The medical home pharmacist role was implemented to define and measure impact on quality of patient care, medication costs and clinician satisfaction.

**Methods:** Priorities for the PCMH pharmacist were defined to reflect both the goals of the organization for continued improvement of quality, affordability and service, and to support primary care provider requests. The roles were implemented at two ambulatory health care clinics serving a combined population of approximately 65,000 patients. Pharmacists received competency-based training prior to being assigned within their health care team. This physical proximity enhanced direct access to and communication with clinicians, support staff and patients. Standardized work processes and documentation templates were used for charting and data retrieval. Pharmacist relationships with clinicians and support staff were established over time and sustained through participation in daily team meetings and face-to-face interactions. Reports were used to identify opportunities for improving patient care and reducing medication costs. This included: hypertension control, opioid use improvement and other utilization opportunities.

**Results:** During the hypertension program pilot, 66 percent of patients managed reached blood pressure goals. Morphine equivalency was reduced an average of 22.5 percent at PCMH medical offices compared to an average of 19.5 percent for medical offices without PCMH pharmacists. Overall non-preferred drug costs reduced by an average of 19.3 percent more in the PCMH medical offices compared to offices without PCMH pharmacists. Drug costs for OxyContin and Razadyne prescriptions were reduced 8 percent and 22.5 percent respectively on average more than medical offices without PCMH pharmacists. On a satisfaction survey, clinicians indicated increased job satisfaction as a result of having a pharmacist in the PCMH. In addition, they indicated that the pharmacist was a valued addition to the PCMH with average time saved reported at 2.4 hours per week per clinician.

**Conclusion:** Pharmacist involvement within the PCMH has demonstrated positive value with improved medication costs, clinical quality and clinician satisfaction.

**5-105**

**Category:** General Clinical Practice

**Title:** Outcome of a pharmacist discharge counseling program for congestive heart failure (CHF) patients

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**Purpose:** A recent New England Journal of Medicine study (2011;365:2287-95) reported the CHF readmission rate to be 11 to 32%. In 2010, Hallmark Health System (HHS) developed a program for identifying CHF patients at high risk for readmission and implemented an intervention of bedside counseling by a pharmacist. While the reason patients get readmitted can be multi-factorial, medication compliance has been shown to be one of the leading causes. Our aim was to show that direct pharmacist intervention could have an impact on the CHF readmission rate in a community health system.

**Methods:** The HHS Pharmacy Department organized a Readmissions Team, in July 2010. The team was charged with developing a pilot pharmacist counseling program that included: patient selection criteria, patient education and a method for documentation. The team also collaborated with case management and the Massachusetts College of Pharmacy and Health Sciences Pharmacy Outreach Program, to create a toolkit to assist patients' access to discharge prescriptions. In January 2011, HHS convened a multi-disciplinary cross-organization Readmissions Team and the pharmacy team aligned with that group. During the study period (January 2011 to January 2012), CHF patients were stratified as high-risk and non-high-risk. High-risk was defined as: age greater than 75, little or no home support and/or on ten or more medications. However, due to staffing constraints, we were not able to counsel all high-risk CHF patients. Therefore, the data is naturally randomized such that we are able to compare the CHF readmission rates between those patients that were pharmacist-counseled and those that were not. Monday thru Friday, the Quality Improvement department sent an e-mail of all CHF patients admitted in the previous 24 hours. Patients were assigned to the decentralized pharmacists who then attempted to make an initial and discharge visit to all high-risk patients. The visits included an introduction to themselves and the CHF readmission project, as well as the taking of a baseline medication history. On the day of discharge, a decentralized pharmacist visited the patient, reconciled the original history with any medication changes, did a full medication teach, assessed if patient will be able to obtain any new prescriptions and answered any questions. The two visits, along with any associated interventions were documented into the appropriate computer systems.

**Results:** For the final analysis both the patients who received just one visit (initial or discharge) or had both an initial and discharge visit were included. An average of 42% of high-risk CHF patients received at least one counseling visit from a pharmacist. An average number of 11

patients (range 4-16) received some amount of counseling per month. Four patients on average (range 0-10) received both initial and discharge counseling. During the study period, the readmission rate for pharmacist-counseled (any counseling) CHF patients bested the HHS CHF readmission rate in all but one month. When graphed, trend-lines demonstrate that both readmission rates have crept up (at a relatively similar rate). However, the average readmission rate for pharmacist-counseled CHF patients is 11% (range 0-25%), while for all HHS CHF patients is 22% (14-32%). The average readmission rate for patients who received both initial and discharge counseling was 10% (range 0-33%).

**Conclusion:** A bedside pharmacist discharge counseling program can be successfully implemented in a community health-system setting and thus help; in part, to lower CHF readmission rates in this setting. Due to the complexity of medications CHF patients receive, any time spent with a pharmacist can impact their care. Based upon the outcome of this program, other discharge diagnoses such as pneumonia should be explored for possible inclusion in an expansion of the pharmacist bedside discharge counseling program.

**5-107**

**Category:** General Clinical Practice

**Title:** Pharmaceutical attention showing improvement in medical adherence and glycated hemoglobin (HbA1C) reduction in diabetic patients.

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**Purpose:** Diabetes Mellitus (DM) is a chronic affection which prevalence has been rising due to lifestyle deterioration, specially regarding feeding habits and physical exercising. In diabetic patients, we can succesfully obtain glycemic levels improvement combining lifestyle reeducation and pharmacologic treatment, which are proved to reduce complications development. Chronic non-degenerative conditions characteristically have worldwide low adherence rates (less then 50%), and this is specially true among diabetic patients, because of treatment complexity. Educational interventions by the multidisciplinary health team markedly improve glycemic control and this is a proper context for the clinical pharmacist to handle broad resources to promote wide understanding about rational use of medication. The different methodological approaches for studying these outcomes, however, leads to diverting results and difficults comparing the obtained outcomes relating pharmaceutical attention to reduction in HbA1c. This study aims to evaluate whether the clinical pharmaceutical acting improves treatment adherence and glycemic control among diabetic patients followed in the Clinical Pharmaceutical Outpatient Clinic, situated in the Internal Medicine Department at Hospital das Clinicas (Clinics Hospital) from University of Sao Paulo, Brazil (HCFMUSP).

**Methods:** We performed a retrospective study, collecting data from medical charts of patients already being followed, during the month of august 2010, and who had had at least five clinical pharmaceutical consultations and whose HbA1c were 7 or higher during their first evaluation. We analyzed 66 medical charts, collecting data as demographic variables (sex, age, degree of education) whether the patient had a caregiver or looked after himself, drug compliance, HbA1c levels and pharmacotherapeutic profile variability. Monthly pharmaceutical consultation was structured to assure adequate drug usage, including drugs dispensation using the pillbox system. Compliances rates were measured through accountings of remaining pills and blisters on the following consultation with the clinical pharmacist and compared to the august 2010 results. Measuring the HbA1c occurred in admission and at the august consultation and were used as treatment efficacy markers. Data was statistically processed with paired T-test and using the GraphPadInStat3 program.

**Results:** We obtained a sample mostly composed of women (66,67%), with ages among 61-70 years (40,9%). Educational evaluation suggested low ranges (less than 4 years of study (53,0%). 53,0% had no caregivers. We noted a marked compliance rate (77,32% 22,33 vs 95,67% 10,28;  $p < 0,0001$ ) and significant reduction in HbA1c levels (9,88% 2,11 vs 9,14% 1,87;  $p = 0,0040$ ). There was no significant differences in the pharmacotherapeutic profiles among the studied patients.

**Conclusion:** Clinical pharmacists intervention resulted in improvement of pharmacologic treatment compliance and, consequently, to a better outcome in glycemie levels among patients with type 2 DM, estimated by the reduction in the HbA1c levels.

**5-108**

**Category:** General Clinical Practice

**Title:** Preparing to be an international relief pharmacist: lessons learned from post-quake Haiti

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**Purpose:** After the January 2010 earthquake in Haiti, hundreds of pharmacists volunteered to help with the massive relief effort. Even now, over two years after the quake, there are still many pharmacists making trips to Haiti to assist with international medical relief efforts. Most of these pharmacists have not received training on disaster response or international relief pharmacy, and report finding very few resources available in this area. Participating pharmacists report encountering multiple unexpected challenges despite their efforts to prepare for their volunteer experience. This case consolidates the experiences of multiple volunteers, and shares the knowledge they gained in the hopes of better preparing future relief pharmacists.

**Methods:** Available online and printed resources were reviewed, and pharmacy volunteers from multiple non-governmental organizations (NGOs) in Haiti completed surveys and were interviewed about their experiences. The results of this research were compiled with information gathered from long-term pharmacy relief workers to create an aggregate of experiences of pharmacists volunteering in Haiti.

**Results:** The data collected from previous pharmacy volunteers was compiled to create a series of recommendations for pharmacists considering involvement in relief work. Recommendations fell into several categories: (1) physical, professional and mental preparation, (2) addressing the challenges of working in a third world country, and (3) clinical pearls. The results of this research were compiled to create a guide to preparing to be an international relief pharmacist.

**Conclusion:** While there are some educational materials available, most of them focus on state-side disaster response and biological warfare. These materials do not address the challenges faced by pharmacists practicing in a resource-limited setting. Access to proper information allows pharmacy volunteers to properly prepare, and make a greater contribution to the population they are serving.

**5-110**

**Category:** Home Care

**Title:** Clinical problems identified with a screening tool for patients starting home infusion therapy

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**Purpose:** Due to limitations in health insurance coverage, patients receiving infusion therapy in the home setting often do not have 24/7 supervision of their care. Rather, where clinically appropriate, the patient or caregiver is expected to administer the ordered infusions independently, typically after one or two teaching visits by a home health nurse. Subsequent home nursing visits are often limited to one per week. In such a largely unsupervised setting, it is critical that the patient/caregiver learns how to correctly administer the therapy and care for the IV catheter, and understands the signs/symptoms of a catheter related infection or an adverse drug effect. This report describes data collected with a standardized tool used to identify clinical issues of concern early in the course of home infusion therapy.

**Methods:** Our company is a national provider of home infusion services. Interactions with patients occur by both pharmacists and support personnel, and are primarily by telephone. A set of data collection tools was built into the pharmacy's patient management software to standardize some elements of these telephonic patient interactions, so that the same clinical information could be collected and gathered into a report regardless of which staff member spoke to the patient. All reported issues were followed up with patient/caregiver re-education, contact with the prescriber, communication with the home health nurse, delivery of any missing supplies, or another appropriate resolution. This data is from a standard list of questions used with patients within 24-72 hours of the start of home infusion therapy. Data was reviewed for completion and errors prior to inclusion in the analysis.

**Results:** The new data collection tool was initiated in early April, 2012. Data was collected from 14 infusion pharmacy sites over a period of 2 months. 296 patient assessment records were completed. Approximately two-thirds (197) of the patients were on antibiotic therapy, 16 received methylprednisolone, 15 were on parenteral pain management, 11 were parenteral nutrition patients, and the rest were receiving various other therapies. More than 10% of the patients had at least one potentially significant issue. A total of 44 issues were identified; a few patients reported more than one problem. The most serious issues were in three patients who had each made a very serious breach of aseptic technique involving the IV catheter, creating a risk of developing a catheter-related bloodstream infection. There were two significant situations where home-based care was delayed by multiple days; three other patients also reported one or more missed doses. Eight patients reported issues related to their IV catheter. Five other patients were not flushing the IV catheter correctly, risking loss of IV access. Seven patients reported pain

uncontrolled by medication; three of these were on service for pain management infusion therapy. Four patients reported a possible adverse drug effect. There were 11 miscellaneous issues. One patient could not afford the ordered parenteral antibiotic, and the pharmacist was able to have the prescriber switch to a less expensive drug.

**Conclusion:** Patients on home infusion therapy may experience a variety of potentially significant clinical problems, such as adverse drug effects, intravascular catheter-related infections, loss of venous access, and therapy interruptions. The data collection tool provided a reporting capability of issues identified by telephonic assessment of new patients.

**Category:** I.V. Therapy / Infusion Devices

**Title:** Hospital infusion center costs for anti-tumor necrosis factor agents

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**Purpose:** Tumor necrosis factor (TNF)-inhibiting drugs are provided to patients with rheumatoid arthritis in the form of an intravenous infusion or subcutaneous injection. Although anti-TNF infusions are typically provided in hospital-based centers, center managers often have limited information about associated treatment costs. Therefore, the purpose of this study was to estimate the total cost of anti-TNF infusion care from a hospital perspective using an activity-based costing approach.

**Methods:** A model was developed using several types of infusion center inputs: hourly wages, time required to provide care, supply and overhead costs, laboratory test costs, infusion center size, and practice pattern information. Founded on existing treatment guidelines, the model assumed 8 infusions of infliximab annually. Base case values were derived from a survey of 5 community hospital infusion centers, previously published nurse and pharmacist time estimates, and expert opinion. Laboratory tests required over the course of a year were totaled and attributed equally to each infusion. Costs were derived from standard national sources. An overhead charge of 29.5% was applied to all costs. All costs were measured in or inflated to 2011 US dollars.

**Results:** Time required for each infusion totaled 168 minutes with 24 minutes attributed to pharmacy and reconstitution processes and the remaining 144 minutes required for administration. The total cost per infusion, including drug and laboratory costs, was estimated to be \$3185. Most of this cost was attributable to the acquisition cost of the infused medication. Of the \$427 not associated with drug, \$93 was associated with recommended laboratory tests. Non-drug infusion costs were estimated at \$334 per infusion including labor and supplies associated with drug preparation and administration, pre-medication, and the treatment of adverse events. Of this amount, \$121 was attributable to non-labor categories (e.g., capital equipment) and management (e.g., inventory and documentation). In contrast, total Medicare reimbursement for a 3-hour infusion would be less than \$120. A separate module including indirect costs (i.e., lost productivity of patient and/or caregiver, transportation) estimated each infusion visit to be associated with an additional \$146 cost to the patient. Sensitivity analyses identified wages as having the greatest influence on model estimates (i.e., resulting in up to a 15% change in non-drug costs).

**Conclusion:** Although drug costs contribute most to the cost of anti-TNF infusion care, personnel, supply, and overhead costs can also be substantial. The model developed in this research can be used to quantify the total cost of providing anti-TNF infusion services so that fiscal returns at the margin can be evaluated at any given institution and can be used to evaluate the impact of different treatment regimens (e.g., less frequent infusions, shorter infusion time). In a market in which reimbursement and efficient use of personnel are keenly important, such a tool can help managers make informed choices about services to be offered and their financial implications.

5-112

**Category:** I.V. Therapy / Infusion Devices

**Title:** Evaluation of an Infusion Pump Pharmacist

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**Purpose:** Smart pump technology is becoming a standard part of the infusion practice in health systems and many facilities struggle to build and maintain drug libraries. Once a drug library is in place it is often difficult to know what improvements need to be made unless the proper use of the available drug library reports are maximized. These problems are magnified when sharing drug libraries across multiple hospitals and pump-programming behavior may be very different. Many practitioners may also desire to make changes but are unfamiliar with the process and instead they revert to BASIC Mode usage. With over 1 million infusions per year on a Large Volume Pump (LVP) alone, a full time pharmacist was funded to coordinate the smart infusion pumps with. This presentation will describe the outcomes since the implementation of this new service.

**Methods:** Smart pump drug libraries were incorporated into infusion practices without adequate understanding or oversight from departments of pharmacy, which lead to disparate processes created to manage them. A pharmacist was recruited and hired to focus on drug library management for the systems large volume, syringe, and PCA pump. This pharmacist was given the opportunity to meet with the pump vendors to train with their field staff, visit each facility to talk with front line practitioners, and connect with other healthcare systems. During this process, reports were produced that provided vital information for pump setting changes. Many of these reports provided valuable data to justify changes that are made in the pump libraries. Critical changes in the pump library and safety improvements were approved by the system-wide Pharmacy and Therapeutics committee prior to implementation. As changes were initiated, practitioners were able to make recommendations to the pump pharmacist to safely expand the drug library. Multiple safety features of the smart pumps that were not utilized to their full extent previously were implemented under the guidance of the pump pharmacist.

**Results:** Prior to having a pump pharmacist, library upgrades were done on a yearly basis with few limit changes to any existing infusions. Currently updates are made to the pump libraries at least quarterly, with improvements made to existing infusions each time. As new medications are commercially available and approved by our P&T Committee, infusion parameters are updated in a timely manner. Monthly reports are provided to facilities to inform them of pump programming behavior and by providing reports to facilities the following outcomes have been observed: Standardization of concentrations that were difficult to define Reduction of basic mode use by more than 7% Expand clinical use of our infusions to maximize smart pump technology

Expand Care Area options to meet nursing needs Reduce alert fatigue on clinical advisories  
Define pump utilization and move pump inventory Initiate updated education for nursing staff

**Conclusion:** Having an infusion pharmacist has changed the quality improvement process for infusion pumps and allowed a greater utilization of infusion pumps. Changes to infusions settings in the pump library are able to be made based on monthly reports for each facility. This has also improved nursing education, and drastically reduced the improper use of the drug library while expanding the library to protect patients.

5-114

**Category:** I.V. Therapy / Infusion Devices

**Title:** Verification activities for a hazardous IV compounding robot

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**Purpose:** After installation, calibration, and initial testing of a chemo robot, the state board of pharmacy allowed preparation of patient doses but required a period of intensive verification by a pharmacist of all aspects of robotic drug preparation. Procedures were developed to comply with the board of pharmacy requirements. Data collection and documentation tools were developed to capture the activities.

**Methods:** Pharmacists were required to verify that each order correctly crossed the interface from the order entry system. Vial selection changes were documented electronically. A pharmacist visually verified each drug vial before it was loaded into the robot. The bag and clamp assembly was weighed before and after compounding in the robot. The expected final weight was calculated based on the dose and drug density and compared to the actual final weight recorded in the pharmacy. The pharmacy final weight and final weight recorded by the robot were compared for each dose. The robot-generated label and pharmacy-generated label were compared to assure that all label information matched. A log of issues was maintained throughout the verification period.

**Results:** During the verification period 1978 patient-specific doses were compounded by the robot. Fifty issues were recorded (2.5% of doses). Twenty-four of the reported issues involved under-filling. It was left to the pharmacists discretion whether to add drug when the dose variance was -3% to -4%. Drug was manually added to any dose that was more than -4% of expected. Half of the reported under-filling issues were in the discretionary range. Mechanical error or calibration problems accounted for 14 of the issues. Faulty products accounted for 9 of the issues. These included misshaped needles, bags underweight during loading, bags leaking, and cracked vials. Two of the recorded issues were related to human error (bag spiked incorrectly after preparation and incorrect bag loaded which was caught by the robot). In one instance we were unable to print a final preparation report from the robot.

**Conclusion:** The issues reported did not result in errors to the patient. The most common issue was under-filling outside of the pharmacy standards or within the discretionary range. The robot detected underweight bags, issues with a lot of needles, and an incorrect bag selection. The data collected were sufficient to demonstrate the overall safety of the device to the board of pharmacy.

5-115

**Category:** Investigational Drugs

**Title:** Establishing an investigational drug service at Intermountain Medical Center

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**Purpose:** Investigational drug services (IDS) were not formalized at the authors institution. The primary service provided by the pharmacy department was to dispense study medications from the central pharmacy. During any given time, the pharmacy was servicing 3 to 4 studies. It was vital to establish an investigational drug service in order to ensure compliance with regulatory requirements. Additionally, this provided a service for investigators conducting research at Intermountain Medical Center.

**Methods:** The Drug Information Service proposed a formalized IDS. The functions of the service would include the following: drug procurement, drug dispensing and preparation, drug accountability, drug storage, drug disposal, drug information, staff education and training, and pre-study site visit support. Study records would be transferred from the Assistant Director of Operations to the newly formed IDS. The first priority would be billing for studies nearing completion. Other priorities included disposing of medications from completed studies, organizing records, establishing a standardized billing structure, securing appropriate space for medications and records, and promoting the service to investigators.

**Results:** Upon the pharmacy directors approval, the service was established in January 2012. The standardized billing structure was approved by the Director of Pharmacy, and has been well received by investigators. To date, billing for all studies is complete. In the first quarter of 2012, the service billed \$15,691.84. A process was developed for the destruction and disposal of study medications. The service has secured space for all investigational study medications. A pamphlet was developed to promote the service. There are currently 7 ongoing studies with an additional 13 under review. Given the increased use of the service, there is a need for additional staff, and a proposal is being sent to administration.

**Conclusion:** The IDS has been successful in establishing effective processes regarding drug procurement, drug dispensing and preparation, drug accountability, drug storage, drug disposal, drug information, staff education and training, and pre-study site visit support. Furthermore, the new billing practices ensure compliance with CMS regulations.

5-116

**Category:** Leadership

**Title:** Review of pharmacy careers: advice for pharmacy students

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**Purpose:** Descriptive summaries and research on influential factors affecting student pharmacists career choice has been utilized by practitioners to aid student development, choose educational experiences, and plan for future career goals. There is currently no research that summarizes different pharmacy careers for student pharmacists or provides advice about pharmacy career development during school. The purposes of this research are to (1) review the literature from the past decade on pharmacy careers and (2) describe the views of experienced pharmacists with regard to career development.

**Methods:** A literature search of various healthcare journal databases, including Medline and Pubmed, was conducted using keywords careers in pharmacy, pharmacy career development, and career planning for pharmacy. The full text of each article was reviewed and articles were excluded if they did not relate directly. Additionally, 35 experienced pharmacists were interviewed on career development. Data was analyzed qualitatively using NVIVO software to identify common themes and word frequencies.

**Results:** Forty different pharmacy careers were identified based on the results of the literature search. Specific requirements for careers were noted as well as an estimated number of pharmacists practicing in those careers for each state. Some of the careers listed were pharmacists in the community, hospital, military, managed care, research, and pharmaceutical industry. Qualitative analysis of pharmacists interviews revealed that developing good study habits, becoming involved in professional organizations and being passionate about your career were the most frequently provided advice on career development. Furthermore, the pharmacists interviewed mentioned patient advocacy, adaptability, networking, and being a pharmacy leader as important factors.

**Conclusion:** This research has presented all contemporary pharmacy career opportunities and insights from experienced pharmacists, which could serve as a great resource for student pharmacists for their career planning and development.

5-117

**Category:** Leadership

**Title:** Evaluation of the preparative and reflective thoughts of post-graduate biopharmaceutical industry fellows teaching experiences in a Doctor of Pharmacy elective course

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**Purpose:** To assess the process by which post-graduate biopharmaceutical industry fellows prepare themselves for providing educational lectures and determine what impact the experience has on their professional development.

**Methods:** An anonymous electronic survey was offered to post-graduate biopharmaceutical industry fellows providing lectures to students participating in an elective course of a Doctor of Pharmacy program. The survey included two phases: a pre-lecture survey designed to evaluate the fellows level of teaching experience and what strategies and resources the fellows used to create their lectures; phase 2 of the survey asked the fellows to reflect on their experiences and assess how they felt they performed and what they could work on to improve their classroom teaching skills. This survey was approved by the Colleges institutional review board.

**Results:** Three of the four fellows with teaching roles in the course participated in the survey exercise. Each fellow provided one two-hour lecture. Two of these fellows had taught before this opportunity, but only one of them taught at the college level. The reference on which they based their teaching method was past experience as a student (3/3), guidance from faculty (2/3), past experience as a teacher (1/3), and guidance from other individuals (1/3). Teaching resources used to prepare the lecture included teaching development programs (2/3), teaching aides from the Internet (1/3), and information provided by faculty course coordinators (1/3). None of the fellows had prepared examination questions prior to this experience and relied on information provided by faculty (3/3), teaching aides on the Internet (1/3), and teaching development programs to help them write these questions (1/3). Prior to this teaching experience, all the fellows felt they were excited about teaching, but only 1/3 felt confident about their abilities. Upon completion of their lectures, all three responding fellows felt their lecture was well received by the students and felt they were prepared to deliver their lectures. Two of the fellows felt they could have improved their lecture by eliminating some of the material, while one of the fellows felt better organization could have helped. The fellows universally felt they would take on other teaching opportunities in the future, and felt the teaching experience helped them develop professionally.

**Conclusion:** Post-graduate biopharmaceutical industry fellows participating as guest lecturers for students of a Doctor of Pharmacy elective course have little teaching experience prior to the

opportunity, but value the professional development offered by the experience. A conscious reflection of developmental experiences can help mentors and learners build on the past for future opportunities.

5-118

**Category:** Leadership

**Title:** Impact of conducting admission interviews on faculty of a school of pharmacy

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**Purpose:** Over the past two decades, the number of schools of pharmacy, as well as the number of pharmacy student candidate applications, has steadily grown. The Massachusetts College of Pharmacy and Health Sciences-Worcester/Manchester (MCPHS-W/M) has increased its Doctor of Pharmacy class size from approximately 165 students to 300 over the past 5 years. The increased number of applicants and candidates accepted has led to a dramatic rise in the number of necessary on-site interviews to fulfill admission goals. During the 2011-2012 academic year, in an effort to distribute service responsibilities, MCPHS-W/M required all School of Pharmacy faculty participate in the on-site interview process (approximately 20 interviews per faculty).

**Methods:** Following the conclusion of the 2011-2012 admission cycle, an electronic survey was prepared and distributed to all faculty within the School of Pharmacy. The survey collected the following information for each participating faculty member: previous experience conducting admission interviews, opinions on the quality of interview training provided to inexperienced interviewers, the number of interviews completed by each faculty member, factors that may have affected the total number of interviews completed, the preferred method for scheduling interviews, and perceptions of the overall interview experience (positive vs. negative). The survey was approved by the Colleges institutional review board.

**Results:** Thirty-seven of 46 faculty members (78.3%) who conducted admission interviews over the past year participated in the survey. Fifty percent (n=18/36) of responders were not current members of the admission committee, however, of these, 6 (33.3%) had prior committee experience. Those who described themselves as non-committee members felt the introduction to the admission interview process was adequate in preparing them for the activity, and 17/18 (94.4%) felt they either mostly or completely understood the admission process; 1/18 (5.6%) felt he/she somewhat understood the process. Although the target interview amount for faculty to complete was approximately 20, only 13 faculty (35.1%) completed >15, [11-15, n=11 (29.7%); 5-10, n=12 (32.4%); <5, n=1 (2.7%)]. Four of 37 faculty (11.1%) described the impact of interviewing on their time as significant, while 17 (47.2%) stated the impact was moderate, 15 (41.7%) as minor, and 1 (2.8%) as no impact. Most faculty (n=30/37; 81.2%) conducted interviews at scheduled times selected during the work week, while 17/37 (43.3%) faculty members conducted interviews during pre-set interview times on evenings and Saturdays. Self reported reasons why faculty did not complete at least 15 interviews included not having

interviews scheduled at submitted times (n=15/18; 83.3%) and not wanting to interview during the work week (n=3; 16.7%). Those faculty that did complete at least 15 interviews described their reasoning based on a sense of responsibility (n=10/19; 52.6%) or enjoyment of participating in the admission process (n=9/19; 47.4%). Finally, a majority of the faculty (n=31/36; 86.1%) felt that conducting interviews created at least a minor connection with the incoming class of students.

**Conclusion:** Overall, faculty were receptive to conducting admission interviews as a job responsibility, but the scheduling process and impact on work time was an obstacle to completing interviews. Providing scheduled times to interview candidates or conducting interviews in the evenings or weekends may assist in overcoming the impact of time required to interview admission candidates.

5-119

**Category:** Leadership

**Title:** Student pharmacists perception of a service learning experience at a charity pharmacy

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**Purpose:** The purpose is to evaluate student pharmacists perception of a service-learning opportunity through the Mississippi Dental Associations Mission of Mercy Pharmacy Clinic.

**Methods:** The University of Mississippi established a charity pharmacy to support the medication needs of the patients of a temporary, free dental clinic targeted to provide dental and pharmacy services to low-income individuals of the Jackson, Mississippi, area. Current PY3 and PY4 students volunteered time to dispense and counsel patients on his/her prescribed medications. A 23-question pre-survey tool and a 32-question post-survey tool were used to assess the student pharmacists perception of the service learning experience. The survey questions examined student demographic data, previous work history, volunteer experience, attitudes and perceptions about community service, and civic, cultural, and social issues.

**Results:** Of the 22 students who completed service learning experience, 100% responded to the surveys (1 PY3 and 21 PY4). The majority of respondents perceived that he/she improved in terms of knowledge/understanding of the health care needs of the community in which he/she served (64%), the barriers to receiving health care in the community that he/she served (64%), how to work with patients who have various levels of health care knowledge (50%). 100% of the students reported that he/she was willing or very willing to volunteer for community service post graduation.

**Conclusion:** These results suggest that participation in a service learning experience was seen as valuable and beneficial. It also offers opportunities for students to grow professionally and personally while providing much needed service to the community.

5-120

**Category:** Nutrition Support

**Title:** Evaluation of parenteral nutrition prescription: pharmaceutical interventions

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**Purpose:** The Parenteral Nutrition Therapy requires the performance of the Multidisciplinary Nutrition Therapy Team (MNTT) to promote the best nutritional care to the patient. The Pharmacist, besides participating in the MNTT, is responsible to act and intervene in the proceedings related to development and preparation of the parenteral nutrition (PN). Before start the parenteral nutrition compounding process, the pharmacist must make an analysis of the prescription as to the suitability of quality and quantity of the components as well as the compatibility between the formulation elements. During this process, the needs must be observed and if the dose of the components prescribed is according with the recommendation. Furthermore, the stability of the formulation is evaluated and if the administration route indicated is compatible with the osmolarity of the solution. The aim of this study was to describe the pharmaceutical interventions performed referring to the NP prescription assess the degree of acceptance the prescriber.

**Methods:** A retrospective study was performed, in which the interventions of PN prescriptions were quantified and analyzed by pharmacists of the telephonic service sector of a company specialized in manipulation of sterile solutions. The company serves public and private hospitals in Brazil. For this study, were analyzed the pharmacist evaluation reports between August 2010 until April 2011. The prescriptions received by the computerized system (alert impediment), only the ones sent by L-Fax. The analysis of data was made with the use of descriptive statistics.

**Results:** A total of 2832 interventions (10.3 interventions/day) were carried out, approximately 2.3 % of the daily total prescriptions (informatics system and Fax). From all performed interventions stand out: Total nutrient admixture (TNA), calcium and magnesium concentration, calcium and phosphate concentration, osmolarity, access port, fat emulsions, and the difference of the final volume. The calcium and magnesium concentration interventions were the most frequent (57%), followed by related to the difference of the volume (18%), osmolarity and access port (6.8%), calcium and phosphate content (4.4%), and TNA (2.8%). 98.5% of the interventions were accepted by prescriber. Among the interventions not accepted, the major ones were about osmolarity and, calcium and magnesium concentration. Provided that it wasn't impeditive, the PN corresponding the pharmaceutical intervention not accepted, was delivered to the hospital with the statement warning.

**Conclusion:** The main pharmaceutical interventions performed were about the stability of the formulation. The pharmaceutical evaluation is an effective method for preventing the occurrence of the physical chemical incompatibility and complications related to the solutions/emulsion. This pharmaceutical assessment allowed to identify the potential instability of the NP and the intervention of MNTT to allowed adequate prescription. The high acceptance rate showed that adding the pharmacist integrates himself to MNTT decreasing the waste of the unstable preparations that can interphere in the cost of the production process and, mainly, avoiding that one preparation not suitable for use is administrated, compromising the clinical security of the patient.

**Category:** Operating Room Pharmacy

**Title:** Effectively communicating the current status of drug shortages in an operative setting

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**Purpose:** Drug shortages have been increasing in frequency and severity in recent years and adversely affecting patient care. One of the most difficult tasks has been keeping abreast of current, ongoing and resolved shortages. Effectively communicating the current status of drug shortages to the appropriate care providers has been a significant challenge. Our institution relied on e-mail communication and posting of signs, which were becoming ineffective due to the rapidly increasing number and severity of anesthesia drug shortages. In an effort to improve communication, the pharmacy department established multiple methods for providing information about current drug shortages to our operating room (OR) staff (anesthesia care providers, nurses, surgeons and pharmacy staff) in a more transparent and timely manner.

**Methods:** A complete list of the current drug shortages that affect perioperative care was compiled. The severity status of each drug in short supply was graded, the action taken was identified, and comments such as look-alike cautions and alternatives were added. This list was posted on a bulletin board directly outside of the OR pharmacy and is updated weekly. This list contains three categories that are colored coded to indicate the severity of the shortage. These categories include: 1) critical (red), 2) ongoing (yellow) and 3) resolved, for now (green). A headliner entitled News Flash was added to post changes that occurred before the next weekly update. Key facts as to why we are experiencing such a dramatic number of drug shortages is also posted. In this setting, most of the drugs in short supply are used by anesthesia care providers. Therefore, a current electronic version of this information was posted on the Anesthesia Departments website, allowing access to information when the provider is not near the bulletin board. A short survey was conducted to assess the effectiveness of these changes to our communication strategy.

**Results:** Informal comments, as well as the survey results, indicate that the changes in our strategy have been positively received and represent a significant improvement over our previous strategy of e-mail communication and sign posting.

**Conclusion:** The communication changes in the perioperative setting have improved the transparency of the drug shortage situation in our hospital, with all providers (anesthesia, nurses, surgeons and pharmacy staff) having access to the same up-to-date information.

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**Category:** Operating Room Pharmacy

**Title:** Use of Tranexamic Acid in orthopedic joint arthroplasty

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**Purpose:** Orthopedic joint arthroplasty has been associated with blood loss resulting in patients having to receive blood transfusions. The following case series will describe the use of intravenous tranexamic acid in total hip and total knee arthroplasty. Of the sixteen patients that received tranexamic acid, seven patients (47%) underwent total hip arthroplasty and nine patients (56%) underwent knee arthroplasty. All sixteen patients were healthy individuals with no prior medical history of atrial fibrillation, DVT, or PE. During the surgery, each patient was given a one time dose of intravenous tranexamic acid. The doses ranged from 10mg per kg up to 1 gram. The drug was administered as a 15 minute infusion in the operating room. The patients were monitored, from closure until discharged, for any drops in hemoglobin <8 mg/dl and for signs and symptoms of a thrombus. If the hemoglobin fell below 8 mg/dl, patients were transfused with two units of packed red blood cells. If patients developed a thrombus, anticoagulation via a heparin dosing algorithm was initiated. After surgery, fifteen out of the sixteen patients (94%) did not require any blood transfusion hospitalization. One patient experienced a drop in hemoglobin from 8.4 mg/dL to 7.9mg/dL three days after their total hip arthroplasty. Two units of PRBC were transfused and the patient was discharged the next day with a hemoglobin of 9.5mg/dl. No patients developed thrombi during admission and were anticoagulated with either warfarin or aspirin during hospitalization. Based on this case series, the use of IV tranexamic acid during joint arthroplasty was associated with a reduction in postop bleeding and transfusion requirements. Additional research is necessary before implementation as standard of care.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

5-123

**Category:** Pediatrics

**Title:** Impact of an intermittent pediatric antimicrobial stewardship program on pharmacist interventions at a children's hospital

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**Purpose:** Antimicrobial stewardship programs have been shown to improve appropriate antibiotic usage and reduce utilization of targeted antibiotics. The CDC is promoting the use of antimicrobial stewardship programs in acute and long term care facilities to improve the appropriate use of antimicrobials in these patient populations. Studies have shown that prospective multidisciplinary programs have the most benefit. The purpose of this study is to show the impact of an intermittent antimicrobial stewardship program in a children's hospital on pharmacists antibiotic interventions.

**Methods:** A retrospective chart review comparing pharmacist interventions pre pediatric antimicrobial stewardship team formation and post. The service was implemented in June of 2011. The pre-intervention period was from November 2010 to April 2011; the intervention period was November of 2011 to April of 2012. The following data was recorded: number of interventions, type of intervention, the interventions acceptance or decline, antibiotic intervened on, and culture data available. Days of therapy of targeted antibiotics were recorded for the same intervention periods. The pediatric antimicrobial stewardship team consisted of an infectious disease pharmacist, a pediatric clinical pharmacist, and a board certified pediatric infectious disease physician. This team met twice weekly and reviewed all patients on antimicrobial therapy in the pediatric intensive care unit, pediatric immediate care unit, and the general pediatric unit. The pharmacist or physician would contact the primary care team of identified patients either by phone or in person with recommendations regarding appropriate antimicrobial therapy. The pharmacist spent approximately 2 to 2.5 hours each day that the team met on preparing for stewardship rounds, participating in rounds, and making recommendations for the team.

**Results:** The number of interventions increased from 43 to 167 from the pre-intervention to post-intervention period. This was a statistically significant increase. ( $P < 0.001$ ) In the pre-intervention group 88.4% of interventions were accepted; in the post-intervention group 77.2% of interventions were accepted. Even though the post-intervention group had a slightly lower percentage of acceptances, the overall cost savings was higher due to the increased number of overall interventions (\$3420 vs. \$11610). In the pre-intervention period, the most common intervention was discontinue antibiotics (60.5%), followed by duration of therapy (20.4%) and

de-escalation (9.3%). The post-intervention group had a similar top three intervention categories with discontinue antibiotics at 43.7%, duration of therapy at 20.4%, and de-escalation at 17.4%. In the pre-intervention period, the most common antibiotics intervened on were vancomycin (27.9%), third generation cephalosporins (25.6%), cefepime (23.3%), and acyclovir (7%). In the post-intervention group, the antibiotics with highest percentage of intervention were vancomycin (19.2%), cefepime (16.5%), third generation cephalosporins (11.4%), and meropenem (10.2%). Meropenem had no interventions in the pre-intervention group. In the pre-intervention group, 60.5% of interventions involved patients with positive cultures; in the post-intervention group, 38.2% of interventions involved patients with positive cultures. Oral antibiotic use and narrow spectrum antibiotic use increased from the pre-intervention period to the post-intervention period when comparing days of therapy per thousand patient days.

**Conclusion:** Implementation of an intermittent retrospective antimicrobial stewardship program had many impacts on pharmacists interventions. The number of interventions increased to near four times the original number. The top types of intervention remained consistent, with an increase in the percentage of de-escalation interventions from the pre-intervention to post-intervention group. The antibiotics that were intervened on remained consistent as well. The difference in the number of patients with positive cultures may reflect the pre-intervention pharmacist focus on patients with positive cultures rather than overall antibiotic therapy regardless of culture results. An intermittent retrospective antimicrobial stewardship program increased interventions, increased cost savings, and increased interventions on targeted antibiotics defined by the CDC.

5-124

**Category:** Pediatrics

**Title:** Early experience with intravitreal bevacizumab compared to laser treatment for retinopathy of prematurity

**Primary Author:** Shaviller D. Waugh, staff pharmacist, Texas Children's Hospital, 6621 Fannin WB1-120, Houston, TX, 77030; Email: sdwaugh@texaschildrens.org

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**Purpose:** Retinopathy of prematurity (ROP) is abnormal blood vessel procession in the retina of the eye in a premature infant and is the leading cause of preventable and treatable childhood blindness in fully developed countries. The induction of vascular endothelial growth factor (VEGF) is the cause of abnormal blood vessel growth and is the contributing factor in the progression of ROP. Bevacizumab is an inhibitor of VEGF, thus making it a potentially effective treatment for ROP. This retrospective review was undertaken in order to assess the outcomes of intravitreal treatment with bevacizumab (0.625 mg in 0.025 mL) compared to conventional laser treatment at a large neonatal intensive care unit.

**Methods:** The institutional review board approved this retrospective case cohort study. The criteria for intervention are: ROP affecting zone 1 with any stage 3 (no plus disease), zone 1 with any plus disease (no stage 3) or zone 2 with any stage 2 or 3 with plus disease. Upon parenteral consent, intravitreal bevacizumab was administered at the bedside with topical anesthesia while laser treatment occurred in the operating room under general anesthesia. The pharmacy and fiscal databases were queried, along with review of ophthalmology records to gather pertinent data. Patients who received intravitreal bevacizumab (IVB) from June 2011 to February 2012 were identified as cases. A control group was identified, consisting of laser treated patients with similar gestational ages and birth weights from December 2009 to February 2012. Demographic and clinical variables were collected and evaluated for efficacy and adverse events. Data were analyzed for statistical significance using Student's t test, Wilcoxon rank sum test and chi-square analysis.

**Results:** The study included 24 premature infants (IVB: n=12, laser: n=12) for a treatment of 44 eyes. Both groups were similar in baseline demographics in terms of APGAR scores and incidences of respiratory distress syndrome, bronchopulmonary dysplasia, intraventricular hemorrhage and patent ductus arteriosus. The mean gestational age was 24.3 +/- 1.5 weeks in the IVB group and 25.3 +/- 1.8 weeks in the laser therapy group (p=0.19). The mean postmenstrual age at the time of IVB treatment was 36.1 +/- 2.3 weeks compared to 37.4 +/- 4.1 weeks for patients who received laser treatment (p=0.35). The mean birth weight in the IVB group was 670 +/- 121 grams and 692 +/- 139 grams in the laser therapy group (p= 0.69). Weight at the time of

treatment for IVB and laser therapy patients was 2157.5 +/- 427.7 grams and 2331.7 +/- 991.8 grams respectively (p=0.6). There appears to be a trend toward a shorter length of stay for inborn patients treated with IVB: 125 +/- 48 days versus 135 +/- 53 days (p=0.08). The IVB group had significantly fewer days on mechanical ventilation: 56 +/- 44 days versus 78 +/- 41 days (p=0.02). Post-operative pain management was required for 33% of IVB patients versus 75% for laser patients (p=0.1). There were no ocular adverse events, such as cataracts or post-treatment infections observed with IVB therapy. Two patients who received IVB treatment required subsequent laser therapy.

**Conclusion:** Intravitreal bevacizumab holds promise as a favorable treatment for ROP as evidenced by a reduction in mechanical ventilation and lack of ocular side effects. Additional studies are warranted to evaluate any potential long-term systemic toxicity with IVB therapy.

5-125

**Category:** Pediatrics

**Title:** Optimization of the Vancomycin Dosing Nomogram in the Regional Neonatal Intensive Care Unit

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**Purpose:** The purpose of this study was to develop a vancomycin dosing nomogram in neonates 14 days of life or greater in the Regional Neonatal Intensive Care Unit (RNICU) at UAB Hospital.

**Methods:** This was a single-center, IRB-approved, retrospective and prospective study of neonates in the RNICU at the University of Alabama Hospital receiving vancomycin therapy. Patients were included if they were 14 days of life or greater and had serum peak and trough levels obtained. Patients with suspected renal dysfunction were excluded from the study. Retrospective data collection was conducted on 80 patients with a total of 240 peak and trough levels used to determine patient specific pharmacokinetic parameters. Pharmacokinetic equations were used to determine each patients volume of distribution (Vd), elimination rate constant (Ke) and drug clearance (CL). Regression analyses were performed to determine predicted Ke and Vd. These values were used to derive a maintenance dose (mg/kg) and interval (hour) for groups based on corrected gestational age. The new nomogram was designed to target peak levels of 20-40 mg/L and trough levels of 10-20 mg/L.

**Results:** Prior to implementation of the revised nomogram, 78% of neonates were subtherapeutic and only 20% had trough concentrations of 10-20 mg/L. To date, 34 patients have been treated prospectively with the revised nomogram. Therapeutic trough concentrations have been achieved 62% (n=21) of the time with a range anywhere from 3.9 29.9 mg/L. Of those troughs not in the desired range, 10 were subtherapeutic (average level 7.6 2.1mg/L) and 3 were suprathereapeutic (average level 24.9 4.3 mg/L). Data collection is still ongoing in patients greater than 43 weeks corrected gestation due to the variability of pharmacokinetic parameters and the small sample size in this age group.

**Conclusion:** Implementation of the revised nomogram provided therapeutic vancomycin trough concentrations more frequently compared to the previous nomogram without causing harm. By achieving therapeutic levels earlier in treatment, patient outcomes should be improved and the emergence of multidrug resistant organisms should be minimized. Also, this study led to more appropriate dosing regimens for neonates in an intensive care unit.

5-126

**Category:** Pediatrics

**Title:** Utility of Early Vancomycin Monitoring to Prevent Acute Kidney Injury in Critically Ill Pediatric Patients

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**Purpose:** To determine if vancomycin monitoring in critically ill pediatric patients in the first 72 hours of therapy results in dosing modifications. To compare the differences in patients who require modification of vancomycin dosing in the first 72 hours of therapy to those who do not require dosing modification.

**Methods:** A retrospective descriptive study was designed. Patients were included in the study if they were initiated on vancomycin while admitted to the pediatric intensive care unit or cardiac intensive care unit at our institution from October 1, 2010 to September 30, 2011 (1 year) and had a vancomycin concentration drawn in the first 72 hours of therapy. Patients were excluded if they did not have a vancomycin level drawn in the first 72 hours of therapy, received vancomycin for peri-operative prophylaxis, or were transferred to the intensive care unit on vancomycin therapy. Patient demographics, dose and schedule of vancomycin, reason for admission to the intensive care unit, timing and value of vancomycin levels, baseline serum creatinine values, and presence of renal replacement therapy were collected and documented. Descriptive statistics were used to characterize the patient population. Patients who had vancomycin levels  $<15$  mg/L drawn at greater than or equal to 8 hours after a dose were considered as not requiring an adjustment in vancomycin dosing schedule or monitoring to prevent elevated levels.

**Results:** A total of 1033 courses of vancomycin met study criteria and had levels drawn within the first 72 hours of therapy. Median patient age was 3.3 years (range 0.01 -23 years). Average baseline serum creatinine for these patients was  $0.55 \pm 0.70$  mg/dl. Vancomycin doses averaged  $14.4 \pm 1.9$  mg/kg per dose. Almost half (45%) of these vancomycin courses were ordered as a one-time dose and not on an initial schedule. Out of the courses administered, 757 (73.3%) were found to have a vancomycin level of less than 15 mg/L at 8 hours with 184 (17.8%) courses having undetectable levels at ~8 hours. Patients with elevated troughs in the first 72 hours of therapy had a higher baseline serum creatinine ( $1.1 \pm 0.8$  vs  $0.55 \pm 0.70$ ,  $p < 0.01$ ), were significantly older ( $9.6 \pm 8.6$  years vs  $5.9 \pm 6.8$  years,  $p < 0.01$ ) but were dosed similarly ( $14.3 \pm 2.1$  mg/kg/dose vs  $14.5 \pm 1.5$  mg/kg/dose,  $p = 0.14$ ).

**Conclusion:** The majority of critically ill pediatric patients do not need vancomycin levels drawn during the first 72 hours of empiric treatment to prevent AKI. Older patients and patients with elevated serum creatinine values may need monitoring in the first 72 hours to prevent elevated trough concentrations. Further investigations are necessary to identify other risk factors for elevated trough concentrations.

5-127

**Category:** Pediatrics

**Title:** Non-antimicrobial Medication Allergies in Pediatric Inpatients

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**Purpose:** Adverse drug events to pediatric patients occur frequently and can result in significant morbidity. Appropriate and accurate documentation of patient medication allergies is important to avoid adverse drug events and prevent patient morbidity. It has been recently reported that many documented allergies to antimicrobial agents in pediatric patients are not truly allergies, but adverse events common to that medication class. Inappropriate documentation of allergies can change prescribing habits of providers and potentially result in unnecessary or inefficient utilization of medications. There are currently no data evaluating non-antimicrobial medication allergies documented in pediatric inpatients. Determination of the accuracy of allergy documentation can lead to further quality improvement efforts for medication utilization in pediatric inpatients.

**Methods:** A descriptive study design was used. Patients were included if they were admitted to Texas Childrens Hospital from October 1, 2010 through March 31, 2012 and had documentation of an allergy to a medication that was not an antimicrobial agent. Patients will be excluded if they do not have medication allergy documentation, or, if the medication allergy documentation is to an antimicrobial medication. Patients will be identified by querying the hospital computer system for the study period. Patient baseline demographics (age, gender) along with admission indication and documented medication allergies will be collected. Medical charts will be reviewed to determine if the patient reaction to the documented medication allergy was documented. Patient medication profiles were reviewed to determine if a patient received a medication that was documented as an allergy or a medication that could cross-react with a medication listed as an allergy during that admission. After data collection is complete, those patients with documented reactions to a non-antimicrobial medication allergy were evaluated to determine if a true allergy exists. Descriptive statistics (mean, median, standard deviations, ranges, percentages) will be used to characterize the population.

**Results:** A total of 3,820 patients were evaluated and 1,710 (44.8%) had a non-antimicrobial medication allergy documented in the medical record. Patients were a mean of 10.4 + 6.3 years of age on admission and 52.1% were male. The most common age group was children (2-12 years of age) representing 49.6% of the study population. The 10 most commonly documented medications in patients included: ibuprofen (1.3%), codeine (0.8%), morphine (0.7%), diphenhydramine (0.6%), lorazepam (0.5%), IVIG (0.5%), soy bean products (0.5%), lamotrigine (0.5%), lactase (0.4%), and hydrocodone/acetaminophen combinations (0.4%).

Many of the documented medications were brand name or combination products and the causative agent in the allergy was not clear. Of the patients with medications documented as an allergy, 841 (49.2%) patients did not have documentation of the reaction associated with the documented allergy. Of the 1,425 separate allergies documented in the population, 748 (52.5%) did not appear to be true allergies, but were noted as side effects or contraindications to therapy. The most common allergic reactions documented included: anaphylaxis type reactions (41.5%), changes in mood or mental status (11.1%), gastrointestinal events (6.9%), and seizures (3.2%).

**Conclusion:** Most non-antimicrobial allergies are not true allergies. Future quality improvement activities should take place to improve rates of documentation and quality of allergy assessment.

**Category:** Pediatrics

**Title:** Beta-blocker Associated Hypoglycemia in Pediatric Inpatients

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**Purpose:** Beta-blockers are commonly used in pediatric inpatients for treating arrhythmias, hypertension, and other disease states. A known adverse event of beta-blocker therapy is hypoglycemia. Reports of beta-blocker associated hypoglycemia have demonstrated that significant morbidity can occur. Individual patient cases of beta-blocker associated hypoglycemia in pediatric patients have been reported, but the incidence of this adverse event in pediatric inpatients is unknown. Additionally, risk factors for the development of hypoglycemia in pediatric patients receiving beta-blockers have not been identified or characterized. By determining the incidence of beta-blocker associated hypoglycemia and the risk factors for beta-blocker associated hypoglycemia in pediatric inpatients, morbidity can be avoided or minimized.

**Methods:** A retrospective case-control study design was used. Patients were included if they have received a beta-blocker (atenolol, carvedilol, esmolol, labetalol, metoprolol, nadolol, propranolol) while admitted to Texas Childrens Hospital in 2011, and had a blood glucose value drawn while receiving beta-blocker therapy. Patients were excluded if they did not have a blood glucose value drawn during beta-blocker therapy. Patients were considered to have had beta-blocker associated hypoglycemia if they had a blood glucose value of < 70 mg/dL while receiving a beta-blocker. Patients with beta-blocker associated hypoglycemia were matched by age, gender, and beta-blocker to 2 patients who did not have hypoglycemia. Data collection for this section of the study included baseline demographics (age, gender, weight), admission diagnosis, indication for beta-blocker therapy, previous surgical procedure, use of medications that could cause hypoglycemia, feeding status, and intravenous fluids containing dextrose. Incidence of hypoglycemia was calculated and stratified by age and type beta-blocker. Comparison of baseline variables in the hypoglycemia and non-hypoglycemia groups will occur with Students t-test, Chi-squared analysis, and Wilcoxon-Rank-Sum test. Odds ratios were calculated for variables to determine risk factors for hypoglycemia, and logistic regression analysis were performed to determine independent risk factors for beta-blocker associated hypoglycemia.

**Results:** A total of 1123 admissions (53.2% male) received a beta-blocker during the study period with a 12.7% overall incidence of hypoglycemia during beta-blocker therapy. Percentages of admissions with hypoglycemia based on beta blocker were: Sotalol (20%), propranolol

(19.1%), esmolol (15.6%), carvedilol (13.4%), labetalol (11.8%), metoprolol (6.7%), atenolol (4.7%), nadolol (0%). The neonatal age group (1-30 days of age) had the highest incidence of hypoglycemia (41.4%) while adolescents (13-18 years of age) had the lowest incidence of hypoglycemia (5.1%). A total of 119 patients with hypoglycemia while on a beta-blocker were matched by age, gender, and beta-blocker to 238 patients who did not have hypoglycemia. Results from logistic regression analysis for independent risk factors will be presented.

**Conclusion:** These are the first data profiling hypoglycemia associated with beta-blocker therapy in pediatric patients, and the overall incidence is high. Neonates may be at the highest risk of hypoglycemia.

5-129

**Category:** Pediatrics

**Title:** Review of pediatric vancomycin dosing regimens

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**Purpose:** UMass Memorial Medical Center (UMMMC) is the largest academic health care system in Central and Western Massachusetts, affiliated with the University of Massachusetts Medical School. The healthcare providers rotating through the UMMC Childrens Medical Center units come from a variety of training programs and clinical backgrounds. Pharmacists are frequently, but not always present on rounds and involved in drug dosing. The current study is a single center, retrospective cohort study evaluating inpatient, intravenous vancomycin regimens, to determine the utility and cost-effectiveness of a pharmacist-driven pediatric vancomycin pharmacokinetic service.

**Methods:** Pediatric patients from birth to 18 years of age admitted to the University campus of UMMC from January 1, 2008 to November 1, 2010 who received 3 or more doses of intravenous vancomycin and had at least 1 trough vancomycin level drawn were included in the study, which was approved by the Institutional Review Board of the UMass Medical School. The primary outcome is to determine the number of dose changes made to a patients vancomycin regimen based on trough levels until a therapeutic serum concentration was obtained and to determine the percentage of patients achieving trough goals set forth by the consensus statement from ASHP, IDSA, and the Society of Infectious Diseases Pharmacists. Secondary outcomes are the number of vancomycin levels drawn per patient and patients with documented patient specific pharmacokinetic calculations, the percentage of patients that required multiple regimen changes to achieve target levels, and to estimate the associated cost of requiring multiple dosage changes.

**Results:** One hundred fifty-two patients met inclusion criteria for the study, to which 78 (51 percent) were male with an average age and weight of 7.05 years and 30 kilograms, respectively. The mean number of dose changes made per patient that achieved a therapeutic trough level was 0.84 plus or minus SD 1.11 per patient (range 0 to 4) and 43 patients (28.2 percent) reached the goal trough level identified for their indication. The mean number of levels drawn per patient was 2.12 (range 0 to 12). Documented pharmacokinetic calculations were not identified for any patient. Of the patients that achieved goal trough levels, 12 (27.9 percent) patients required at least two dose changes to reach goal, and had a mean of 3.05 levels drawn (range 1 to 12). All daily doses are routinely batched by the central pharmacy and sent up daily. Following a dose change, these are frequently wasted and subsequent doses are prepared and sent for the

remainder of the day. Based on a study patient of average weight, drawing two levels and altering the dose twice increases the associated cost by approximately 2,250 to 4,900 dollars, including room and board for one additional night in a general medicine or intensive care unit bed, respectively.

**Conclusion:** The majority of patient regimens reviewed had few dosage changes, though they did not achieve recommended trough levels. When a goal level was obtained, multiple drug levels were required in a portion of patients. Whether patient-specific pharmacokinetic calculations would achieve target levels faster and decrease the number of regimen changes and drug levels could not be established, however the impact of providing appropriate and cost conscious therapeutic drug monitoring, including reducing the number of drug levels drawn, wasted medication, and shortening inpatient stays as well as ensuring safe and efficacious dosing regimens may be substantial.

5-130

**Category:** Pediatrics

**Title:** Implementation of a pediatric decentralized pharmacy technician service to facilitate patient access to discharge medications, verify discharge medication reconciliation and increase pharmacist involvement in the discharge process

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**Purpose:** Pediatric patients require the use of many extemporaneously compounded medications or other specialized formulations that are not commercially available at many outpatient pharmacies. Patient families may encounter significant difficulty when trying to fill prescriptions after discharge from the hospital. Pediatric patients are also at high risk for medication dosing or administration errors outside of the hospital if caregivers or outside pharmacies are not familiar with pediatric medications. The decentralized pharmacy technician service was launched to ensure accuracy of discharge medication reconciliation, increase patient access to discharge prescription medications through a bedside delivery service, and increase the opportunity for medication counseling by a pediatric pharmacist prior to discharge.

**Methods:** One full time decentralized pharmacy technician began providing services throughout pediatric inpatient units in June 2011. With the assistance from a nursing unit based pediatric pharmacist and nursing staff, the technician determines which patients are anticipated to be discharged and if they will be sent home with prescriptions. The technician will then survey families to see if they wish to utilize the bedside delivery service and gathers information necessary to process the prescriptions in the outpatient pharmacy associated with hospital. Simultaneously, the technician helps to troubleshoot any issues that may come up within the prescription filling process, including accuracy of the discharge medication reconciliation. When the technician encounters any type of discrepancy between inpatient and outpatient medication orders, a pediatric pharmacist is consulted to assess the situation and intervene if necessary. The technician also schedules pharmacist medication counseling by appointment with families as requested. If a family chooses not to use the bedside delivery service, the technician will offer to fax the prescriptions to their desired pharmacy and will still inquire if the patient or caregivers would like to speak to a pharmacist regarding discharge medications.

**Results:** From June 2011 to June 2012, the decentralized pharmacy technician has filled prescriptions for 1,331 patients and coordinated medication counseling sessions with 16.7% of these patients. Medication reconciliation discrepancies have been found in approximately 7.5% of prescriptions which have required intervention from the provider. Recently, a pharmacy

student on clinical rotations has been added to the pediatric pharmacy team with the responsibility of counseling all patients receiving new discharge medications regardless of requests by caregivers under the supervision of a pharmacist. This has raised the medication discharge counseling rate to 55% of patients receiving prescriptions.

**Conclusion:** The decentralized pharmacy technician service has improved patient access to discharge medications and to medication counseling by a pediatric pharmacist. This service has also caught and corrected discharge medication reconciliation discrepancies that otherwise may have gone unnoticed. In addition, the service has increased the volume of prescriptions processed by the outpatient pharmacy associated with the hospital. Further qualitative data is needed to measure the effects of the decentralized pharmacy technician service on patient medication adherence and overall patient experience.

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**Category:** Pediatrics

**Title:** Pharmacy student-led inpatient medication education rounds in a pediatric teaching hospital

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**Purpose:** In the realm of pharmacy education and practice, there is a push toward the development of clinical skills early in one's career. Pharmacists are encouraged by the American Society of Health-System Pharmacists (ASHP) and other professional organizations to improve their clinical skills and play a more direct role in patient care. One of the most important clinical skills for a pharmacist to develop is the ability to effectively educate patients and their families about medications. By empowering the patient and their families with knowledge, we encourage them to take an active role in their own healthcare. Pharmacists and pharmacy students, as medication experts, have a unique opportunity to ensure that patients and their families make the best use of their medications. Despite pharmacists' extensive knowledge regarding medications, due to time constraints, inadequate staffing, and the absence of a well-designed counseling program, the responsibility of medication education prior to discharge has primarily been assigned to nurses. Medication education can, however, be consistently provided by pharmacy students, accompanied by licensed pharmacists, when a structured and practical counseling program is developed and implemented.

**Methods:** Pharmacist preceptors were responsible for overseeing and accompanying 6th year pharmacy students, on their management/leadership rotation at Boston Children's Hospital, as they educated patients. Students reviewed profiles of patients on the general pediatrics floors, selected 4 to 5 patients, and prepared to counsel the patient and/or their family on 1 to 3 of their current medications. Students were, however, expected to understand all of the medications the patient was taking in order to be prepared for any questions they may have. The patients selected were provided education at any time during their hospital stay and it was not reserved for the day of discharge. At the conclusion of each medication education session, students documented the visit in the patient's electronic medical record, in the form of a pharmacy consult note.

**Results:** During the two-week pilot of this program there were 45 counseling attempts made by the pharmacy students accompanied by a pharmacist. 36 (80%) patients and their families were successfully counseled and the medication education session was subsequently documented in the patient's electronic medical record. An average of 28 minutes was spent by the pharmacy

student and an average of 14 minutes by the pharmacist preparing for each session, and an average of 11 minutes was spent by both the pharmacy student and the pharmacist educating the patient and/or their family.

**Conclusion:** Despite the common barriers of limited time and inadequate staffing that prevent pharmacists from regularly educating patients on their medications, medication education can be consistently provided by incorporating pharmacy students into a structured and practical counseling program.

5-132

**Category:** Pediatrics

**Title:** Utilization of a smart pump bolus feature in a pediatric intensive care unit at a large children's hospital

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**Purpose:** In the Pediatric Intensive Care Unit (PICU), sedation bolus doses for intubated patients required medication vial removal from the automated dispensing cabinet and nurse manipulation and dose preparation away from the bedside prior to administration. A change in practice to utilize the smart syringe pump for bolus doses was implemented in October 2011, allowing bolus doses to be administered from a syringe running a continuous infusion. The objective of this quality improvement study is to determine if this practice change will impact the following: time to bolus dose administration, time the nurse is away from the patients bedside, frequency of central line access, drug wastage and drug cost.

**Methods:** This was a non-randomized observational quality improvement study. Data was collected via chart review and manual timing of nursing staff. The following data was collected pre-implementation and will be collected post-implementation: nursing time away from the bedside to retrieve and prepare bolus dose; bolus dose drug cost; amount of drug wastage; frequency of central line access for bolus dose administration.

**Results:** There were 20 patients evaluated during the two-weeks prior to implementation, only nine of which were included in the time study. The total time for the nurse to leave the bedside, retrieve and prepare the medication and subsequently infuse the bolus dose was 3:17+/-1:03 minutes. The nurses were administering the bolus over 38.4+/-31.1 seconds, which is much lower than the recommended 2-3 minutes in the literature. The total wastage calculated during this period was 27,044 mcg of fentanyl (238.2+/-162.4 mcg per patient day), 56.8% of all fentanyl removed, and 186.5 mg of midazolam (1.43+/-1.44 mg per patient day), 23% of all midazolam removed. This wastage was due to the single dose vials retrieved from the Omnicell utilized for bolus dosing. Delivery from the syringe pump eliminates this wastage. Only 28.6% of patients received boluses from a central line, and 14.3% received boluses via central or peripheral route. Bolusing from the pump reduced the potential for central line entries by 5.4+/-2.9 entries per day. Additionally, to date, the nursing staff at TCH has been very pleased with the sedation bolus practice change at TCH. There have been no reported adverse events due to the change in practice. The annualized cost savings calculates to 26% for midazolam and 74% for fentanyl. This, in addition to the reduction in midazolam and fentanyl wastage has provided benefit to the system in an era of an increasing number of drug shortages.

**Conclusion:** We implemented a change in practice utilizing smart intravenous pump technology to administer sedation boluses. Preliminary data indicates that this can improve consistency in practice and adherence to medication administration recommendations, and reduce the following: time to bolus dose administration, time the nurse is away from the patients bedside, frequency of central line access, drug wastage and drug cost. Further data collection is underway to better determine the impact of this practice change on these outcomes.

**Category:** Pediatrics

**Title:** Hepatitis associated with single dose administration of micafungin in a pediatric transplant patient.

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**Purpose:** Micafungin is an echinocandin class antifungal agent FDA approved for the treatment of candida species infection, but is often used off-label for treatment and prophylaxis of invasive aspergillosis. Echinocandins are generally well tolerated with a desirable side effect profile. Per the package labeling, approximately two to fifteen percent of patients receiving echinocandin treatment experience transient liver enzymes elevation. However, the relationship of micafungin use to elevation of liver enzymes has not been well documented. We describe a post-transplant pediatric patient who developed acute hepatitis following a single dose of micafungin. To date, there is only one reported case of acute hepatitis associated with micafungin use. Patient was a 9 year old female with a complex past medical history significant for unresectable myofibroblastic tumor status-post multi-organ transplant of the esophagus, stomach, pancreas, spleen, liver and small bowel in October 2011. Induction agents used during transplant included rabbit anti-thymocyte globulin and methylprednisolone. Her post-transplant immunosuppression regimen consisted of enteral tacrolimus, intravenous mycophenolate mofetil and a 32-day course of intravenous methylprednisolone. An abdominal wound vacuum-assisted closure (VAC) dressing was placed to promote healing of the surgical incision. On post-operative day (POD) 17, purulent drainage from the wound was noted during routine VAC change. Patient was emergently brought to the operation room for wound incision and drainage. Samples were obtained and sent for culture. Within 24 hours, cultures and gram-stain from both wound and drainage grew abundant candida albicans and few pseudomonas aeruginosa. Micafungin 4 mg/kg intravenously given every 24 hours was initiated for the treatment of the candidal wound infection. The patient received 100mg of micafungin given intravenously as appropriate for her weight. No other medication changes were made at this time. The patient tolerated the medication infusion with no events. Approximately sixteen hours after initiation of micafungin, routine laboratory test results revealed marked elevation of liver enzymes with aspartate aminotransminase (AST) of 284 unit/L, alanine aminotransaminase (ALT) of 260 unit/L, total bilirubin of 0.6 mg/dL, direct bilirubin of 0.4 mg/dL and alkaline phosphatase (AP) of 301 unit/L. During this time, the patient was also noted to have a blotchy rash on her face which resolved with a dose of intravenous diphenhydramine. An emergent abdominal ultrasound and ileum pluck biopsy was performed which showed no findings. Prior to the initiation of micafungin, the patient's AST was 29 unit/L, ALT was 37 unit/L, total bilirubin was 0.1 mg/dL, direct bilirubin was 0.1 mg/dL, and AP was 139 unit/L. These laboratory values have remained normal and stable since POD 3. The suspected offending agent micafungin was immediately discontinued and the patient was started

on fluconazole intravenously for treatment of her candida wound infection. Of note, the patient was on tacrolimus and mycophenolate mofetil for immunosuppression which have been reported to be hepatotoxic. However, the patient has been receiving these medications prior to the event with therapeutic levels within goal ranges. Twenty-four hours after the discontinuation of micafungin, laboratory tests revealed liver enzymes have returned back to baseline. Upon evaluation of the adverse drug event, patient scored 7 points on Naranjo's algorithm, indicating a probable adverse reaction to micafungin.

**Methods:** n/a

**Results:** n/a

**Conclusion:** n/a

**Category:** Pediatrics

**Title:** Clostridium difficile infection in an 11 month old child

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**Purpose:** This patient (pt) case characterizes the development of C. difficile colitis in an 11 month old pediatric patient and describes factors which may have contributed to the development of C. difficile colitis in this pt. C. difficile is occurring with increasing frequency in the United States especially in the elderly population. Children are considered to be at lower risk than elderly patients with an incidence 2.5 times less than the elderly pt. Most data available are derived from adult populations. Risk factors for development of C. difficile in the adult population are age greater than 65 years, female gender, antimicrobial use, hospitalization, serious underlying illness, gastrointestinal procedures, use of proton pump inhibitors, and proximity to pts with symptomatic C. difficile infection. Risk factors have not been as well defined in the pediatric population, however antimicrobial use may play a role along with proton pump inhibitors, immunocompromise, elemental formula feeding via gastric or intestinal tube, prolonged hospitalization, proximity to infected patients, and intestinal disorders. This patient was an 11 month old child with a past medical history of asthma, gastroesophageal reflux disease (GERD), and kidney disease who presented to the emergency department (ED) with a 2 day history of low grade fever and tugging at the right ear. The pts home medications included budesonide nebulizers, albuterol nebulizers, and lansoprazole tablets. The pt was diagnosed with acute otitis media and was prescribed amoxicillin 40mg/kg PO TID for 10 days. The pt was discharged from the ED. The pt returned to the ED nine days later presenting with diarrhea lasting 6 days with approximately 14-15 episodes per day. A C. difficile test was positive at that time. The pt was treated with oral vancomycin 125 mg four times daily for 14 days and symptoms resolved. Two risk factors for C. difficile colitis in this pediatric patient were the use of amoxicillin and the use of lansoprazole. Perhaps the inhaled budesonide treatment is a risk factor in this pediatric pt depending on the possible absorption of budesonide and its subsequent effect in the immune system of this pt.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

**Category:** Pediatrics

**Title:** Neonatal intensive care unit antimicrobial stewardship: early onset sepsis in neonates

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**Purpose:** Evaluating the utilization of empiric antibiotics for rule out sepsis in neonates is an important role of the Neonatal Intensive Care Unit (NICU) pharmacist. The purpose of this study is to compare the duration of antibiotics for early onset sepsis in patients after implementation of a sepsis treatment algorithm. The NICU pharmacist is a member of the NICU infection team who developed the treatment algorithm. The team was formed as part of a unit wide initiative to reduce the NICU nosocomial infection rate by ten percent and Central Line Associated Blood Stream Infection (CLABSI) rate to zero.

**Methods:** The institutional review board approved this prospective review of all NICU patients on antibiotics. A daily census report is generated to identify patients on antibiotics and therapy is evaluated for appropriateness, duration, and compliance with the early onset sepsis algorithm. The NICU pharmacist discusses patients with the NICU team regarding the duration of each antibiotic, enters in stop dates, and discontinues antibiotics within 48 hours of initiation of empiric therapy if applicable on a daily basis. There is also a retrospective review of antibiotic doses in which a report is generated from the electronic medical record to determine antibiotic doses given. This data is used to calculate antibiotic doses per 1000 patient census days to determine overall antibiotic usage within the unit. The infection team meets monthly to discuss patients that have a negative early sepsis work up and are given antibiotics beyond 48 hours. Compliance within the algorithm was also assessed.

**Results:** Baseline data collected in February and March of 2011 revealed that 71 percent of NICU patients on empiric antibiotics for a negative early onset sepsis workup received over 48 hours of therapy (average 2.5 days). In May 2011, pharmacy presented the data to the NICU infection team. An early onset rule out sepsis algorithm was developed and initiated in September 2011. In October 2011, NICU pharmacists started to enter antibiotic stop dates on active antibiotic orders after collaboration with the team. Data review in December 2011 to January 2012 revealed that only 10 percent of patients on empiric antibiotics received over 48 hours of therapy (average 1.7 days). During the same time period, we have decreased our total antibiotic usage from 840 doses per 1000 patient census days to 568 doses per 1000 patient census days.

**Conclusion:** Antimicrobial stewardship is an important function within the NICU for pharmacists. Development of an early onset sepsis treatment algorithm for neonates complemented unit wide initiatives to reduce nosocomial infections, thus reducing antibiotic usage.

**Category:** Pediatrics

**Title:** Intranasal fentanyl versus intravenous morphine for acute pain in the pediatric emergency department

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**Purpose:** The intranasal (IN) route of pain medication administration has potential benefits, including decreased need for IV access, reduced time to analgesia, and increased patient satisfaction. Intravenous (IV) morphine is a commonly used method of pain medication administration; however, the placement of IV lines in children can be difficult because of small veins and lack of patient cooperation. The primary objective of this study was to determine if IN administration of fentanyl decreased time to pain medication administration compared to IV morphine for patients with the diagnoses of burn, fracture, or abscess in the pediatric emergency department. Secondary objectives included assessment of the adequacy of pain relief with IN fentanyl compared to IV morphine, incidence of IV placement in the IN fentanyl group, incidence of adverse effects related to administration of IN fentanyl, and characterization of the use of additional pain medications.

**Methods:** This retrospective cohort study compared the time to pain medication for all patients arriving at the pediatric ED between September 1, 2011 to November 30, 2011 with the diagnoses of burn, fracture, or abscess to patients with the same diagnoses from the same time period in 2010, prior to the introduction of IN fentanyl. The following information was obtained from patients medical records: age, sex, weight, diagnosis, dose and type of all medications given, route of administration for all pain medications given, time of pain medication order (fentanyl or morphine), time of pain medication administration (fentanyl or morphine), pain scores, and adverse effects.

**Results:** The study analysis include a total of 189 patients (IN fentanyl 81 pts and 108 pts for IV morphine). There was no difference between groups for the primary outcome, median time to first pain medication (22 minutes IN fentanyl vs. 19 minutes IV morphine,  $p = 0.19$ ). Median pain scores did not differ between the two groups. IN fentanyl was not associated with any adverse events. Only 8 patients in the IN fentanyl group required IVs, with most of them being placed for fluids or sedation.

**Conclusion:** IV morphine and IN fentanyl are equally fast methods of delivering pain medication to children arriving at the pediatric ED with acute pain due to burn, fracture, or abscess. IN fentanyl is a novel, safe, and effective method of medication administration that can decrease the need for IV access.

**Category:** Pharmacokinetics

**Title:** Status and Improvement of Blood Sampling Errors by Clinical Pharmacokinetic Consultation Services

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**Purpose:** The biggest problem during blood sampling is misreading the concentration of drugs in the blood serum, resulting in treatment failure. The objective of this study is to evaluate the status of blood sampling errors and to propose a direction for improvement.

**Methods:** This research conducted analysis to determine if differences existed in blood sampling errors by drug type, in kinds of errors, and in errors between different health care facilities with an aim to understand the causes of these errors. The results were later published in a manual and distributed to medical staff as a way to reduce the number of such incidences.

**Results:** Among the 216 Clinical Pharmacokinetic consultation services we provided between January 1 and August 31, 2011, 78 (36.11%) had blood sampling errors. The result of analysis by drug type revealed 32 cases (41%) related to digoxin, 18 cases (23%) related to vancomycin, 14 cases (18%) to phenytoin, 11 cases (14%) to valproic acid, and 4% other. The types of error included failure to reach steady state (60%), failure to sample immediately prior to administering medication (33%), non-compliance with directions for taking medicine (7%), in that order. When a re-sample was recommended following an error, re-sampling was conducted in 38% of cases, not conducted in 49% of cases, and 13% other, suggesting that many patients may not have received appropriate medical treatment. Based on the above results, a manual was created on blood sampling experiments for medical staff. The introduction to the manual covered blood serum concentration and the concept of steady state, listing the most common errors by drug type in order of frequency using graph illustration, marking the sampling times for optimal easy comprehension. The manual was distributed to health care facilities and wards with high error rates with an explanation of the importance of blood sampling times.

**Conclusion:** Errors were again analyzed during the 6-month period following the improvement activities. Results showed that the activities were very effective, as errors during that period had improved by 25.68%, marking a 28.88% reduction from the 36.11% error rate.

**Category:** Pharmacokinetics

**Title:** Pharmacokinetics (PK) of different formulations of oral azacitidine (CC-486) and the effect of food on PK in patients with hematologic malignancies

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**Purpose:** An oral formulation of azacitidine (oral AZA) allows for extended dosing compared with 7-day treatment with the parenteral formulation with potential safety and/or efficacy benefit, and can increase patient convenience and access to treatment. In two phase 1 studies, various formulations of oral AZA were evaluated by measuring PK parameters and assessing the effect of food on PK in patients (pts) with hematologic malignancies.

**Methods:** In study 1, 16 pts received a single subcutaneous azacitidine (SC AZA) dose of 75mg/m<sup>2</sup> on Days 1 and 15, and a single oral AZA dose ranging from 180 to 1200 mg on Days 3, 5, 17, and 19; three tablet formulations (immediate release [F3 and F6], enteric-coated [F4]) and 1 capsule (CAP) were evaluated. In study 2, 17 pts received 300mg doses of oral AZA (48 hours apart) as 3x100 mg F6 tablets (fasted), and as 2x150 mg F8 tablets (fasted and fed [600 calories]) in a three-way crossover design; F8 is an immediate release formulation.

**Results:** In study 1, oral AZA plasma concentration-time profiles following administration of F3, F6, or CAP formulations were similar, with a median T<sub>max</sub> of ~1.0, ~1.0, and ~1.3 hr, respectively, and showed features of multiphasic decline in the terminal phase. For F4, a median T<sub>max</sub> of ~3.0 hr was observed. Based on observed PK profiles and PK parameters, F6 was selected for further development. In study 2, to date, results are available for the first 10 pts enrolled. Under fasted condition, oral AZA plasma profiles after F6 and F8 administration were similar, with comparable PK (mean +/- SD) parameters (AUC = 316 +/- 209 vs 309 +/- 180 ng\*hr/mL; C<sub>max</sub> = 211 +/- 156 vs 178 +/- 105 ng/mL, respectively). After administration of the F8 formulation under fed condition, a delay in T<sub>max</sub> of ~1.5 hr was observed. PK parameters for F8 under fasted and fed conditions were similar (AUC = 309 +/- 180 vs 316 +/- 171 ng\*hr/mL; C<sub>max</sub> = 178 +/- 105 vs 143 +/- 64.5 ng/mL, respectively).

**Conclusion:** Oral AZA is rapidly absorbed following administration of various formulations. Little or no effect of food on oral AZA PK was observed with the F8 formulation, except a T<sub>max</sub> delay of ~1.5 hr under fed condition; thus, patients may take the F8 oral AZA formulation with food without compromising drug absorption.

**Category:** Pharmacokinetics

**Title:** Improvement of vancomycin utilization in a community teaching hospital

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**Purpose:** Pharmacokinetic parameters must be taken into consideration to optimize the utilization of agents such as vancomycin. Currently, at our institution, dosing and monitoring does not follow a standardized approach which may potentiate suboptimal outcomes. The objective of this study was to implement a pharmacist-driven pharmacokinetic service to improve the utilization of vancomycin.

**Methods:** A three month prospective study was conducted at Hunterdon Medical Center. Quadramed Computerized Patient Record System (QCPR) was utilized to identify patients receiving at least one dose of vancomycin from January 2012 to March 2012. Patients were evaluated for appropriateness of initial dosing based on weight and renal function and pharmacokinetics were calculated for all subsequent doses. This dosing strategy was used to assess for therapeutic troughs and compare to retrospective data collected January 2011 to May 2011.

**Results:** One hundred and seven patients in the Phase II portion of the study received at least one dose of vancomycin; of these forty-seven patients (43.9%) were able to attain a therapeutic trough as compared to the seventeen out of one hundred patients (17%) included in Phase I of the study ( $P=0.00010$ ). Improvements were seen when assessing the percentage of patients who were able to attain a therapeutic first trough in Phase I and II, 25% and 39.3%, respectively ( $P=0.0372$ ). In assessing composite number of troughs not drawn there were forty-seven patients who were not monitored with troughs in Phase I and thirty-five patients in Phase II who required troughs but did not have them drawn ( $P= 0.1349$ ); one hundred and nineteen troughs were requested in Phase II. Forty-eight cost saving interventions were recommended and accepted, including dose increases/decreases, frequency increases/decreases, and discontinuation of the agent.

**Conclusion:** Improvement in vancomycin utilization was observed after the implementation of a pharmacist-driven pharmacokinetic service.

**5-140**

**Category:** Pharmacy Law / Regulatory / Accreditation

**Title:** Assessing the impact of a law case assignment for third professional year pharmacy students

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**Purpose:** The objective of this study is to maximize the students understanding and applications of the US law.

**Methods:** Third professional year pharmacy students enrolled in the US Pharmacy Law and regulations course were asked to team up in a group of two and prepare a patient case. The case should be analyzed from legal and ethical perspectives showing the various law approaches and discrepancies/controversies. Students were required to submit a written paper (2-3 pages) describing the case analysis and their recommendations. At the end of the course, students were asked to fill out a 16 items questionnaire related to the course learning outcomes and the assignment. Simple descriptive statistics were used to summarize responses to all questions.

**Results:** Participation rate was 97% (97/100 students). Questionnaire analysis showed that the majority of students agreed that this assignment was beneficial (95.8%) and helped them to better understand the law related to the case (91.7%). Most of the student (92.8%) agreed that the teaching methods used were helpful in acquiring a better understanding of the course material, and 91.8% recommended keeping this case assignment as part of the course.

**Conclusion:** The law case assignment provided students with an opportunity to identify/apply related laws to patient cases. Furthermore, it increased their understanding of this particular law, enhancing the recalling process.

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**Category:** Pharmacy Law / Regulatory / Accreditation

**Title:** Utilizing technology in the development of an anesthesia auditing program.

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**Purpose:** A Joint Commission survey finding in 2004 promoted the development of an auditing process to ensure proper documentation of controlled medication for inpatient surgery areas. Our site found a number of discrepancies both within documentation and inventory of the automated dispensing cabinets in the surgical area. To decrease the discrepancies and improve relationships between pharmacy and anesthesia, a pharmacy technician position was created. This position is responsible for: conducting audits, expanding technology, and customer service for the anesthesia department. The audit results are then tracked and reported out on a monthly basis.

**Methods:** The pharmacy auditing technician began a process in 2004 to audit a 10% sample of general anesthesia cases and cardiac anesthesia cases based on baseline discrepancy data. In 2004, this volume amounted to 13 audits performed daily. During this time and in the years following hiring a pharmacy auditing technician, other changes occurred in the surgical department that affected discrepancy outcomes: expansion of the electronic medical record for documentation of medication administration, expanded use of a IT solution ARKS (Anesthesia Record Keeping System) to view medications administered during surgery, and the addition of more automated dispensing cabinets in this area. Hiring the pharmacy auditing technician also enhanced the working relationship between the pharmacy and anesthesia departments. The pharmacy auditing technicians findings were used to educate providers with poor documentation performance. The addition of Automated Dispensing Machines within each surgical room ensured further control and proper documentation.

**Results:** From 2004-2011 a total of 23,842 audits have been performed. The overall compliance rate of proper documentation in 2004 was 50%. With the addition of an Certified Pharmacy Technician in late 2004 the number of audits increase from 1,034 in 2004 to 3,128 in 2005 (67%), and the compliance rate increased by 9% in 2005 to 59%. In 2006 the Anesthesia Record Keeping System was implemented and the compliance rate increased by 13% to 72% overall. When the expansion of Automated Dispensing Machines was added to all surgical rooms in 2009 the overall compliance increased to 85%. 3,313 audits were performed in 2011 and compliance was 87% overall this is an increase of 37% compliance since the program was developed in 2004.

**Conclusion:** An auditing program developed at our hospital has proven to increase overall compliance with anesthesia documentation. The creation of a dedicated Pharmacy Technician,

the increase of technology, and the support of leadership have driven increased positive results. The department will continue conducting audits and reporting results on a monthly basis and goal is to achieve 100% compliance.

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**Category:** Pharmacy Technicians

**Title:** Using web based open-source software to organize, expand, and manage pharmacy technician training within a health-system program

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**Purpose:** Accredited pharmacy technician training is becoming an increasingly integral component of advancing the pharmacy practice model. Few tools exist to electronically organize and manage the learning environment in pharmacy technician training programs. Available programs are often proprietary, costly, or cumbersome for the user, creating significant barriers for health-system based programs without existing online learning tools in place. Utilizing open-source software provides a platform to incorporate online testing, social media, two-way evaluation, and course materials. Open-source software offers a user-friendly, easily accessible mechanism for effectively managing a technician training learning environment within a health-system setting.

**Methods:** A consistent open-source software platform was used for all applications incorporated into the examined health-system training program. Exams, quizzes, presentations, evaluations, and course materials were loaded into a web application for targeted deployment to students throughout the course of the program. Students completed assignments in an online environment, using assigned credentials to the site. Each student was provided a personal laptop to complete assignments. Online assignments complimented live didactic lessons, laboratory training, and experiential rotations. Feedback from evaluations and exam responses were exported to spreadsheet software to support effective data analysis. A social media component allowed the program faculty to interact with students online and from mobile devices to communicate important information and provide unique learning opportunities.

**Results:** Students completed 15 exams and quizzes online during the course of the training program. Evaluations were completed by students after each classroom lecture, clinical rotation, and in a weekly self-reflection. Preceptors used the tool to complete students evaluations. The data extrapolated from the evaluations allowed program faculty to make timely corrections to address areas of concern. Accreditation surveyors formally remarked that the open-source platform was developed with the same standards and considerations as an online pharmacy residency system.

**Conclusion:** Health-system based technician training programs benefit from utilizing open-source software applications to manage content and communication within the pharmacy learning environment. The platform is cost-effective, user friendly, and provides data resources needed to expand the health-system training model.

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**Category:** Pharmacy Technicians

**Title:** Medication reconciliation in the emergency room and continued patient education regarding home medications before discharge

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**Purpose:** Medication reconciliation is important in order to maintain accurate medication information for each patient as mentioned in the National Patient Safety Goals. It was identified that our medical facility was not meeting previously established goals concerning reconciliation of patient medications. Furthermore, the level of patient and family education regarding home medications was not at a satisfactory level to ensure patient medication compliance. This project was created in order to increase reconciliation of patient medications as well as to educate patients and their families about their medications in order to increase medication compliance and correct medication usage.

**Methods:** Positions with the job title Medication Reconciliation Technician were created for the sole purpose of medication reconciliation in the Emergency Department. Pharmacy technicians with extensive knowledge regarding medications and pharmacy processes were trained to compile an accurate list of patient medications by contacting pharmacies, physicians, and assisted living facilities. A medication reconciliation form was designed and implemented system-wide to ensure consistency amongst facilities. A screening process was employed in the Emergency Department that identified patients that met specific criteria (diabetes, heart failure, 10 or more medications) that would benefit from medication education. In order to successfully educate patients regarding administration and compliance of home medications, pharmacists received literature and attended a presentation that discussed effective ways to convey important information such as medication directions, side effects, purpose, and etc. to patients.

**Results:** Data was collected over a sixteen month period regarding medication reconciliation in which there was a tremendous increase in the total number completed as well as the percentage of patients admitted with a completed medication reconciliation. Initially, approximately 128 medication reconciliations were completed which represented 21% of total Emergency Department Admissions per month. At the conclusion, with implementation of trained staff and appropriate materials, 545 medication reconciliations were completed, representing 83% of total Emergency Department admissions per month. Data for patient education following medication reconciliation was collected over a five month period. From those selected through the screening process, 33% successfully received education regarding their medications from a clinical pharmacist. At the conclusion, by increasing specificity of selection criteria and therefore

decreasing the amount of patients who would require education, the number of patients selected through the screening process successfully received education regarding their medications from a clinical pharmacist more than doubled. This was made possible by fine-tuning the selection process by creating a more specific criterion.

**Conclusion:** The medication reconciliation project was successful in increasing the percentage of medication reconciliations completed from total patient admissions in the Emergency Department thus identifying and resolving discrepancies between home medications and those ordered within the hospital setting. While ultimately successful, the patient education project suggested that in order to effectively impact patient knowledge of home medications on a larger scale that would show more observable results, additional resources would be needed. A necessary resource would be a pharmacist with a specific designated role of patient education that could educate each screened patient about their medications.

**Category:** Pharmacy Technicians

**Title:** An innovative role for pharmacy technicians: formal education and training of pharmacy students

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**Purpose:** The increase in the number of students and the need to expose all of them to institutional practices increases the teaching responsibilities of pharmacists but also provides an opportunity to involve pharmacy technicians in teaching. This project utilized technicians expertise and involved technicians in the development of educational materials and instruction of pharmacy students in both laboratory and experiential settings.

**Methods:** Certified pharmacy technicians participated in three courses: (1) a second year College of Pharmacy class that included a laboratory experience simulating a mock hospital pharmacy; (2) an Introductory Pharmacy Practice Experience (IPPE) course for third year students that included a one day visit to an Investigational Drug Service (IDS) Pharmacy; (3) a fourth year Advanced Pharmacy Practice Experience (APPE) in Institutional Pharmacy that included a one week experience in an IDS Pharmacy. The level of technician participation in each of the courses varied. For the laboratory experience, technicians assisted with writing modules, preparation of the supplies, demonstrating pharmacy compounding techniques, and working with the students at the lab. The IPPE one day experience was designed by technicians and pharmacists and was mainly coordinated by technicians. The APPE one week experience was designed and coordinated by pharmacists with the assistance of technicians.

**Results:** Two technicians developed nine modules for the lab class focusing on sterile and non-sterile compounding using a template provided by the course coordinator. The modules were combined down to four to accommodate time constraints. Prior to the class, the technicians prepared supplies and organized the work stations. On lab days, the technicians were assigned to a station, explained the assignment, answered questions, and provided students with feedback on their technique. The results of a student course evaluation of the lab experience yielded a score of 4 out of 5 (5=extremely positive). Two IDS pharmacists and two technicians were involved in planning the IPPE experience. They developed a structured program that included reading material, quizzes, pharmacy dispensing, drug receipt, accountability, and compounding activities. Having a set program enabled the participation of all IDS technicians in teaching on a rotational basis. An IDS pharmacist met with the students briefly to demonstrate and discuss the pharmacists role in the Service. The main teaching responsibilities were handled by technicians.

Students were asked to rate their experience at the end of the day (1=poor while 5=best). Of the 18 students that rotated through the Service during one academic year, 17 completed the survey and the average rating was 4.3. The APPE experience was designed by two IDS pharmacists but relied on the assistance of the Services technicians. Technician-led activities accounted for about 40% of the student rotation. The activities included those described in the one day IPPE rotation plus more advanced activities. The time remaining was spent on projects and discussions with a pharmacist. This structured program allowed for rotating teaching responsibilities among IDS technicians. Involving technicians in designated aspects of the students experience freed up pharmacist time and provided students the opportunity to benefit from technicians expertise and to better understand the important role that technicians play in patient care. At the end of the academic year, technicians rating of their satisfaction with the teaching experience was 4.2 (1=extremely negative to 5=extremely positive).

**Conclusion:** Pharmacy technicians can participate in the preparation of educational material, coordination of student experiences, and active teaching. Technician participation has the potential to free pharmacists time, expand the scope of technician practice, and increase their job satisfaction. It provides the students opportunities to interact with those who are most experienced in the technical aspects of pharmacy practice and gives them a better appreciation of the expertise and contributions of pharmacy technicians to excellent patient care.

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**Category:** Pharmacy Technicians

**Title:** Examining the value of accredited pharmacy technician training by comparing organizational pharmacy calculations competency assessments within a health-system

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**Purpose:** Interest among hospital organizations to partner with or internally develop accredited pharmacy technician training programs is growing. Although accredited training is a large component of the Pharmacy Practice Model Initiative recommendations, little data exists to effectively measure the efficacy of accredited training within the hospital practice setting. A technicians ability to perform accurate pharmacy calculations is critical to safe and effective medication preparation. The team aims to compare technician competency assessment scores of practicing pharmacy technicians and technician students enrolled in an accredited training program.

**Methods:** Students in the examined training program spend forty didactic contact hours over a fifteen-week time period focused on pharmacy calculations. The students learn basic and advanced calculations needed to perform in various pharmacy practice settings. Within the same organization, the practicing technician staff underwent a required pharmacy calculations competency to measure skills relevant to job responsibilities. The pass rate for the competency was set at greater than or equal to eighty percent. The competency was simultaneously deployed to both technician students and the practicing technician staff. The first and second attempt pass rates were compared for both test groups to determine whether didactic training is comparable to experiential training, specifically in relation to a technicians ability to perform accurate pharmacy calculations.

**Results:** The competency was initially deployed to 12 technician students and 138 practicing technicians. The technician students had a seventy-five percent first pass rate and a one-hundred percent second pass rate. The practicing technician group had a sixty percent first pass rate. The second pass rate for the practicing technician group will be completed by September, 2012. A second group of 12 technician students will also complete the competency assessment in September 2012.

**Conclusion:** The curriculum provided in an accredited technician training program provides technician students with additional training and a higher competency level related to pharmacy calculations. Hospital organizations that expect practicing technicians to perform pharmacy

calculations as a part of assigned duties will find value with technicians trained in accredited training programs.

5-146

**Category:** Pharmacy Technicians

**Title:** Analysis of refill times and par levels to best utilize staff resources in a community health system

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**Purpose:** In 2012, a two hospital community health system north of Boston, MA was tasked with expanding its Liquid Unit-Dosing Services. It was determined that better utilization of current staff would be the best avenue to accomplish this task. This necessitated an adjustment of refill times and par levels in the automated dispensing cabinets (ADC) to allow the necessary staff resources for this expanded service. A secondary outcome of this workflow analysis is better staff satisfaction and patient care.

**Methods:** All of the ADCs would be evaluated to determine if the stock levels were appropriate. A formula was created based on the quantity of medications removed during a ninety day period and standard stock medication would be determined based on usage levels. The levels were calculated by dividing the total number of medications removed by the amount of days in the period and then multiplying by a factor of 2 and 9; for the minimum and maximum respectively.  $[(\# \text{ meds removed/days}) \times 2] = \text{Minimum}$   $[(\# \text{ meds removed/days}) \times 9] = \text{Maximum}$ . Monitoring of the census, loading of medications, and refills were reviewed over a twenty one week period from 1/8/12 6/2/12. A ninety day time study was also performed, using a date range of 10/7/11 1/4/12, to determine when the highest concentration of medication removals was occurring. Currently the refill times in the morning refill are 1000 - 1200 and in the evening 1800 - 2000. By analyzing the activity time, the optimal refill time will be able to be determined. Reviewing the times showed that the best refill option, to avoid congestion at the ADC would occur 1300 - 1500 with the evening refill shifting to the overnight at 0100 - 0300.

**Results:** Based upon the results of the time study, the times of greatest medication removal occurred between 0600 0900 and 1800 2000. Reviewing the times showed that the best refill options, to avoid congestion at the ADC; would occur from 1300 - 1500 and the second refill shifting to the overnight from 0100 - 0300. After, the implementation of the new refill times and par levels; the number of medications refilled decreased by 8.5% over the twenty one week period (1476 per week average to 1351 per week average). During the analysis period the average daily census remained constant (approximately 240 patients) as well as the number of new medications loaded (average of 302 per week)

**Conclusion:** Adjusting refill times and par levels allowed for the continued expansion of our oral liquid unit dosing program. This process also allowed us to better coordinate the timing of batch refills to help alleviate congestion at ADCs while at the same time expanding a Pharmacy service line to better serve our patients. The refill process now occurs during non-peak administration times; which is an added benefit to both our patients and nursing staff.

5-147

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Cost drivers associated with Clostridium difficile infection in a hospital setting

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**Purpose:** Since 2000, Clostridium difficile infections (CDI) have become endemic among hospitalized patients. While it has been estimated that CDI results in ~3 million cases of diarrhea/colitis and \$3.2 billion in excess costs per year, few studies have investigated the drivers behind these costs. The purpose of this analysis was to describe in-hospital resource utilization driving the cost burden of CDI within a managed care setting.

**Methods:** 21,177 patients with the following: inpatient diagnosis of CDI (ICD-9-CM 008.45),  $\geq 18$  years, and  $\geq 12$  months of prior health plan eligibility between 01/01/2005-10/31/2010, were identified from the HealthCore Integrated Research Database (HIRDSM). Charts were obtained for 500 subjects via systemic random sampling without replacement. The earliest CDI-diagnosed hospital stay was targeted for medical chart abstraction. Standardized data collection forms were used by trained nurses/pharmacists to abstract data from medical charts on demographics, admission type and condition, CDI symptoms, severity, medications administered, in-hospital resource use (ICU/CCU), doctor consultations, discharge and laboratory data.

**Results:** Chart patients were primarily female (62.2%), Caucasian (72%), with mean age 66(17.6) years. Median cost and length of stay of the hospitalization were \$13,153 (\$8,209-\$26,893; 2011 USD) and 7 (5-11) days respectively. 64.8% were admitted with CDI/diarrhea and 92.2% received a CDI lab test during their stay. Following CDI diagnosis, 15.8% and 2% had mucosal inflammation and colectomy, respectively; 54.2% experienced abdominal pain, 47.6% vomiting, 42.6% dehydration and 53.4% were isolated. 12.4% stayed in an ICU for an estimated 12.2 (12.3) days. 95.2% received metronidazole and/or vancomycin treatment. 34.8% and 29.8% received gastroenterologist and infectious disease consultations with a mean of 8.7 (15.6) and 11.6 (19.4) visits, respectively. 82.5% were discharged with a CDI diagnosis along with a prescription for metronidazole, vancomycin or rifaximin.

**Conclusion:** Prior studies have demonstrated significant incremental economic burden associated with Clostridium-difficile associated diarrhea in terms of direct costs to the health system. The results of this study suggest that consultations, ICU stays, and prolonged hospitalization stays for pharmacological treatment and observation are predominant contributors to this increased burden.

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**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Impact of extended infusion piperacillin-tazobactam (PT) on length of stay (LOS) and PT utilization at a community hospital

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**Purpose:** Piperacillin-tazobactam extended infusions have been reported to have potential clinical and cost advantages compared to traditional thirty minute infusions. Reports are based upon kinetic modeling, in vitro studies, and several clinical studies from hospitals. This study evaluates the impact of extended infusions of PT on LOS and PT utilization at a community hospital.

**Methods:** Literature was reviewed for clinical benefit of extended infusion PT compared to traditional infusion times, and the potential cost advantage associated with converting from traditional to extended infusion dosing was considered. The conversion from various doses administered every six to eight hours over a period of thirty minutes to 3.375 grams every eight to twelve hours over a period of 4 hours was approved by the hospitals Antibiotic Stewardship, Pharmacy and Therapeutics and Medical Executive Committees. Educational sessions were provided to nurses and pharmacists and newsletters were used to communicate the change. The facility's smart pumps were programmed for the new rate of delivery. Hospital LOS of all patients initiated PT therapy and utilization of the drug were measured for three month periods before and after the conversion. Since PT stock par levels remained the same throughout the control and study periods it was determined that purchase data was a reasonable index of utilization. Conversion took place March 2011. The control period was March to May 2010 during which patients treated with PT received various doses of the drug as a 30 minute infusion. The study period was March to May 2011 during which patients received 3.375 grams as an extended four hour infusion.

**Results:** There were 184 patients in the control period and 226 in the study period, a 23% increase in number of patients treated in the study period. An overall 4.3% increase in hospital admissions occurred during the study period compared to the control period. The hospital LOS for patients in the control period was 8.83 days compared to the study period of 7.62 days. This was a 13.2% decrease when adjusted for an overall small change in LOS hospital wide. The number of grams of PT purchased declined from 9423 in the control period to 7830 in the study period, a 13% reduction.

**Conclusion:** Patients treated with extended infusions of PT were associated with reduced LOS. More patients were treated with the drug during the study period. Patients received fewer grams

of PT when administered as an extended infusion compared with the traditional thirty minute infusions.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Pharmacists intervention on improving medication side effect scores in a community hospital setting

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**Purpose:** The Centers of Medicare and Medicaid Services (CMS) measures hospital quality of care through a publically reported patient satisfaction survey called the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS). This survey aids in providing monetary incentives for hospitals to improve their quality of care and enhance public accountability. Initially a voluntary program in 2006, CMS now links HCAHPS participation with financial reimbursement. At our community hospital, percentage scores for staff explaining medication side effects were set at a goal of greater or equal to 60 percent. The objective of this study was to determine if pharmacist intervention would improve HCAHPS scores within this particular category while improving both nursing and patient knowledge of medication side effects.

**Methods:** Nurses were educated by a pharmacy resident on how to teach medication side effects to patients during their daily medication administration. Nurses were responsible for teaching one drug side effect per day per patient, and reinforcing the knowledge by writing the side effect on the white board in the patients hospital room. Pharmacy resident implemented medication side effect discharge information for patients per floor and educated patients on the medications administered during their hospital stay. Progress of the study was measured by a change in HCAHPS scoring from baseline, whiteboard education usage, pharmacist teach-back method, and patient readmission rates.

**Results:** The oncology floor experienced a 33 percent increase in medication side effect scores, while there was a 17 percent decrease in scores on the telemetry floor. Although there was an overall decline, an upward trend in scores began after the end of the study period. Whiteboard usage for education purposes improved weekly, with 73 percent of patients being able to recite medication side effects upon initial counsel. Language barriers were the primary reason for unsuccessful medication counseling, in which nursing translators were used to resolve communication difficulties. One patient was readmitted within 30 days, with an unrelated diagnosis to medication counseled during the prior visit. Lastly, there was an increase in discharge information in writing category scores which may have been attributed to the information given to the patient during pharmacist medication counseling.

**Conclusion:** With continued implementation, pharmacist intervention should assist in enhancing medication counseling to patients, (especially in decentralized hospital pharmacies), and ensure

continued patient and nursing medication side effect literacy. There should also be an improvement in future HCAHPS medication side effect scores and overall hospital scores that would help make certain maximum CMS annual payment amounts are received.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Inpatient Resource Utilization for Acute Coronary Syndrome: An Analysis Using the Healthcare Cost and Utilization Project (HCUP) Databases

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**Purpose:** Acute coronary syndrome (ACS) encompasses a range of acute ischemic cardiac conditions; common estimates cite 1.2 million hospital discharges for ACS in the United States in 2009. In 2015, the projected direct healthcare costs for coronary heart disease, the majority of which consist of costs for ACS, are estimated at \$46.8 billion. The current analysis describes hospital discharge data and related inpatient resource utilization patterns for patients with ACS in a nationally representative sample.

**Methods:** We used the ACS Impact Hospital Discharge Analysis Tool, a web-based tool designed to analyze ACS-related hospital discharge data from the Healthcare Utilization Project (HCUP). Discharge data were obtained from the HCUP Nationwide Inpatient Sample (NIS) and the State Inpatient Databases (SID). The NIS contains all discharge data from participating hospitals; in 2009 this included 1,050 hospitals in 44 states, approximating a 20% stratified sample of US community hospitals. The SID contain a 100% sample of inpatient discharge data from participating states (26 states in 2009), encompassing about 90% of all US community hospital discharges. Discharges from the 2008-2009 NIS and SID were included for all patients aged >18 years with at least one diagnosis of ACS indicated by the International Classification of Diseases, 9th Revision (ICD-9) code 410.xx (except 410.x2, 411.1x, 411.8x). Using both the NIS and SID, the variables evaluated for each discharge included patient demographics, cardiovascular events and procedures, length of stay, discharge status and total charges. Additionally, using data from 9 participating states in the SID, repeat visits for unique patients within a calendar year were linked, allowing analysis of repeat admissions for these patients. The length of stay, primary diagnosis and total charges were evaluated between the first and subsequent admission.

**Results:** The 2009 NIS included discharge data from approximately 6.5 million inpatient stays, 0.90% of which had a diagnosis of ACS (N=58,767). The majority of discharged patients were females (52.9%) aged 65 years or older (63.7%). The most common comorbidities across discharges included hypertension (41.7%), congestive heart failure (32.8%), and diabetes (27.8%). The majority of discharges were due to a myocardial infarction (81.1%). The discharge

status was death for 13.3% of patients. The median length of stay (LOS) was 4 days (mean 7.6) with a median charge of \$30,393 (mean \$63,195) per discharge. The 2009 SID included 62,138 patients with a diagnosis of ACS, of which 42.7% (n=26,504) experienced more than one repeat admission within the calendar year. Approximately three-quarters (76.6%) of the readmissions occurred within 60 days from the initial discharge date. The median LOS and median charges were similar between the first and subsequent admission (4.0 vs. 4.0 days LOS, and \$31,236 vs. \$24,905), respectively.

**Conclusion:** In this large all-payer inpatient care database findings highlight the significant clinical and economic impact in ACS patients. The number of repeat inpatient admissions was high, with almost three-quarters of repeat admissions occurring within 60 days of the primary discharge.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** A phase III prospective analysis of outcomes seen with the implementation of a new alcohol withdrawal protocol within a large teaching institution

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**Purpose:** To determine the effectiveness of house-wide use of a new Acute Alcohol Withdrawal Protocol post the single floor pilot study. The primary endpoint is to improve patient outcomes by decreasing 1) length of stay, 2) restraint use, 3) transfer to a higher level of care, and 4) injury to the patient and clinicians. The secondary endpoint is to determine protocol effectiveness. The new protocol allows physicians three options to manage alcohol withdrawal: 1) monitoring, 2) as needed benzodiazepine medication regimen, 3) scheduled benzodiazepine medication regimen, or 4) combination of as needed and scheduled medications. The protocol focused on utilizing the Clinical Institute Withdrawal Assessment (CIWA-Ar) and Richmond Agitation Sedation Scale (RASS) to determine withdrawal severity and sedation.

**Methods:** All evaluable patients on the alcohol withdrawal protocol were included from November 2011 to April 2012. A minimum length of stay of 72 hours was required. Patients in the intensive care unit or behavioral health unit over 24 hours were excluded.

**Results:** 35 medical patients were included in the study. There was no difference in baseline characteristics between the pilot and house-wide study. The average length of stay was not significantly different between the Phase III trial (7.46 days) and pilot study (5.93 days) ( $p = 0.158$ ). 23% of patients in the current trial required restraints as compared to 7% in the pilot study ( $p = 0.056$ ). Protocol adherence to monitoring CIWA-Ar and RASS prior to or after administering a medication was low.

**Conclusion:** The house-wide implementation of the protocol resulted in similar outcomes, and thus maintained the quality of the pilot study results. Low incidence of patients requiring transfer to a higher level of care and injuries reported. Further education opportunities include: standardizing the use of CIWA-Ar monitoring among the nursing staff and holding a benzodiazepine medication when CIWA-Ar  $< 8$  or RASS  $-2$  to address concern for over-sedation.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Clinical and economic evaluation of vemurafenib in metastatic melanoma patients with implications for the MassHealth budget

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**Purpose:** In 2012, the American Cancer Society estimated 76,250 new cases of melanoma will be diagnosed in the US in both men and women. 9,180 are estimated to die from melanoma. The incidence of melanoma is 26.7 per 100,000 males and 16.7 per 100,000 females with a four percent probability of developing metastatic melanoma according to the Surveillance Epidemiology and End Results (SEER) from 2004-2008 from 17 geographic regions. Metastatic melanoma is associated with a poor prognosis. The most common and previously only FDA approved agent for metastatic melanoma is dacarbazine. Overall, dacarbazine therapy and off label treatments have demonstrated response rates of no more than 20 percent. Thus, little consensus exists regarding a standard chemotherapeutic regimen for patients with metastatic melanoma. In August 2011, an oral BRAF specific inhibitor, vemurafenib, was FDA approved for the treatment of metastatic or unresectable melanoma in patients with a documented BRAF positive mutation. Vemurafenib showed an improved overall and progression free survival in a randomized phase III trial when compared to dacarbazine in metastatic melanoma patients. At six months, 20 percent more patients were alive in the vemurafenib group than in the dacarbazine group. Vemurafenib was promptly added as category 1 recommendation by the National Comprehensive Cancer Network (NCCN) for metastatic melanoma patients with a documented V600E or K mutation of the BRAF gene. This clinical, economic, and budget impact analysis was conducted to evaluate the addition of vemurafenib to MassHealth, the Massachusetts Medicaid program, budget for BRAF V600E mutation positive metastatic melanoma patients. In addition to estimating the budget impact of vemurafenib therapy from the MassHealth perspective, other factors such as patient preference for oral vs. IV chemotherapy, response rates, population size, cost of genotyping assays, cost of management of adverse effects, and the incremental cost difference between treatment with dacarbazine and vemurafenib were evaluated.

**Methods:** A systematic literature review of clinical and economic evidence was conducted using PubMed and MEDLINE. The budget impact analysis (BIA) was based on MassHealth's coverage of 1.3 million patients over a 1 year time horizon. Budget costs were confined to total chemotherapeutic treatment costs associated with stage IV malignant melanoma. The proposed

scenarios make an effort to compare the theoretical use of vemurafenib and dacarbazine in the affected MassHealth population. The model compared treatment with dacarbazine alone and in combination with vemurafenib. An equal proportion of females and males enrolled in MassHealth was assumed to account for discrepancies in incidence of melanoma between the two genders. The model included the costs of treatment, side effects, administration, and healthcare provider services. One way sensitivity analyses were performed related to alterations in progression free survival, incidence of metastatic melanoma, cost of BRAF V600 testing, percent of patients with positive BRAF V600E mutation, and costs of adverse events. Inputs of the model were based on the pivotal studies, SEER data, Centers for Medicare and Medicaid Physician Fee Services (CMS), and publicly available sources.

**Results:** Our clinical data were derived from a Phase III study, which compared the use of dacarbazine versus vemurafenib in patients with stage IV metastatic melanoma, and a Phase II study, which evaluated the efficacy and overall survival of vemurafenib in patients with stage IV metastatic melanoma. Vemurafenib was found to be more effective in patients who carry the BRAF V600E mutation, which is present in 40 to 60 percent of melanoma patients. The time to disease progression was found to be 5.3 months for vemurafenib vs. 1.6 months for dacarbazine. The overall survival for vemurafenib was 84 percent at six months versus 64 percent for dacarbazine. The median overall survival found was 15.9 months in the Phase II study and the overall survival was not reached at the time of data analysis in the Phase III study, which is significantly higher than the median overall survival of 7.9 months after the initiation of dacarbazine. Economic evaluations of melanoma have shown the majority of resource consumption is attributable to late stage disease and the terminal phase of treatment. From 2004-2008 the median age at diagnosis for melanoma of the skin was 60 years of age. The growth in the elderly population is, therefore, expected to increase the number of melanoma patients. It is expected that the increase in resource utilization associated with caring for older melanoma patients will further increase the financial burden of treating melanoma. The budget impact model compared theoretical utilization of dacarbazine and vemurafenib. Since dacarbazine was the only FDA approved chemotherapeutic agent utilized for metastatic melanoma before the approval of vemurafenib, the model focused on the current practice of dacarbazine alone. The inputs incorporated in the current practice scenario included the duration of treatment of dacarbazine of 1.6 months as this was the median time to progression found. For the projected scenarios, if the patient was not eligible for vemurafenib, as indicated by presence of BRAF V600E gene, they were assigned to dacarbazine. The first scenario is the base case which includes 50 percent of patients with metastatic melanoma having the BRAF V600E gene as shown in literature search, and therefore are to receive vemurafenib, a duration of vemurafenib treatment, which is the progression free survival of 5.3 months, and the most likely base case costs for diagnostic testing, monitoring, outpatient services, adverse events, and administration. With the population of MassHealth enrollees at 1,300,000 and the incidence rates reported by SEER, the number of patients that would develop metastatic melanoma would be approximately 11 patients in the population of interest. Previous practice of using just dacarbazine for all 11 patients, the budget is estimated to be \$31,873 per year. For our base case scenario, the total projected budget was found to be \$314,347 per year. The budget totals were most sensitive to progression free survival and the incidence of metastatic melanoma. Utilizing a base case estimate and a median progression free survival of 5.3 months per person treated, the addition of vemurafenib to the MassHealth formulary will add a cost of \$9,885 per month per person treated.

Treatment with dacarbazine alone is associated with a treatment cost of \$1,811 per month per patient treated.

**Conclusion:** Even though vemurafenib offers a potential for a longer progression free and overall survival than dacarbazine in metastatic melanoma, the expense may not justify the approximate eight month increase in overall survival over other alternatives such as dacarbazine. The economic analysis was limited by the relative paucity of long term clinical data available. Long term studies will further contribute to the assessment of future economic and clinical implications regarding the use of vemurafenib. Stakeholders such as policy makers, physicians, and patients should consider the progressive nature of metastatic disease and the inevitable mortality of the targeted population before deciding to implement this therapy based on MassHealth budget constraints.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Cost-efficacy analysis of cabazitaxel for the treatment of hormone-refractory metastatic prostate cancer patients

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**Purpose:** In combination with prednisone or prednisolone, cabazitaxel is indicated for the treatment of patients with hormone-refractory metastatic prostate cancer (mHRPC) previously treated with a docetaxel-containing regimen. Cabazitaxel was evaluated versus mitoxantrone in an open-label randomized phase III trial, the TROPIC study. The purpose of our study was to evaluate the cost-efficacy of Cabazitaxel for the treatment of patients with mHRPC previously treated with a docetaxel-containing regimen, using mitoxantrone as a comparator.

**Methods:** Cabazitaxel and mitoxantrone efficacy and safety data were based directly from the TROPIC trial. Two different efficacy parameters were considered: overall survival (OS) and progression free survival (PFS). The costs of the two therapeutic options were calculated based on the direct cost of the drugs, treatment duration and the probability of granulocyte colony-stimulating factors (filgrastim) use. This study was conducted from an institutional perspective the hospital perspective.

**Results:** In the TROPIC trial, the median OS was 15,1 months with cabazitaxel and 12,7 months with mitoxantrone, and median PFS was 2,8 months in the cabazitaxel group and 1,4 months in the mitoxantrone group. Median number of treatment cycles was six for cabazitaxel and four for mitoxantrone. The most frequent clinically significant grade 3/4 adverse events were neutropenia (cabazitaxel (82%) vs. mitoxantrone (58%)). The marginal efficacy of cabazitaxel vs. mitoxantrone is 2,4 months for OS and 1,4 months for PFS. Considering OS as efficacy parameter, the incremental cost-efficacy ratio (ICER) calculated for is 147.389 ( $\approx$  185.000 USD). When PFS is considered, the ICER calculated is 248.871 ( $\approx$  312.300 USD).

**Conclusion:** Based on this analysis, the ICER calculated for cabazitaxel are too high for it to be considered a cost-effective option in the treatment of mHRPC patients previously treated with a docetaxel-containing regimen, when compared with mitoxantrone.

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**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Clinical and economic implications of substituting dexmedetomidine for propofol in patients during a recent national drug shortage: examination of hospital patients undergoing uncomplicated coronary artery bypass graft (CABG) surgery

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**Purpose:** Propofol, when compared to other standard sedation regimens, has been shown to reduce total healthcare costs in coronary artery bypass graft (CABG) surgery patients receiving short-term sedation by decreasing the time to extubation. However, the convergence of several events, such as drug recalls and the interruption of propofol production lines, precipitated a national shortage of propofol necessitating the use of alternative agents. The purpose of this study was to evaluate the clinical and economic implications of substituting dexmedetomidine for propofol in patients undergoing isolated, elective CABG surgery from the perspective of a large, metropolitan academic medical center.

**Methods:** This retrospective cohort study was approved by the institutional review board with a waiver for informed consent. The Society of Thoracic Surgeons database was queried for all patients that underwent CABG surgery between January 2008 and December 2011. Patients were considered for inclusion if they underwent isolated, elective CABG surgery and were sedated with propofol (January 2008 to March 2010) or dexmedetomidine (October 2010 to December 2011). Eighty-four patients were included in this investigation with 42 patients in each arm. The two cohorts were matched 1:1 based on age, gender, bypass time, and number of grafts. The primary outcome of this study was time to extubation. Secondary outcomes were length of stay (LOS) in the intensive care unit (ICU) and hospital, the need for adjunctive opioid therapy, and the associated cost savings.

**Results:** The mean time to extubation was lower in the dexmedetomidine cohort than the propofol arm but showed no statistical significance (11.8 hours versus 22.6 hours,  $p=0.085$ ). Similarly, the difference in ICU length of stay was not significant between the dexmedetomidine and propofol groups (2.3 days versus 3.3 days,  $p=0.062$ ). Length of overall hospital stay was 7.0 days in dexmedetomidine-treated patients and 8.5 days in the propofol-treated patients ( $p=0.012$ ). Additionally, opioid requirements did not differ significantly between the two treatment groups. The average cost of drug therapy was greater in the dexmedetomidine arm but was recuperated by savings in the cost of room and board associated with the reduced hospital LOS. A simple pharmacoeconomic analysis revealed a net expected annual cost savings of more

than 100,000 dollars in the dexmedetomidine-treated group. However, there was no significant difference in the total observed hospital costs ( $p=0.630$ ).

**Conclusion:** The use of dexmedetomidine in elective CABG surgery patients did not significantly reduce time to extubation or length of ICU stay when compared with propofol. However, dexmedetomidine therapy was associated with a decreased length of overall hospital stay, which potentially translates to significant cost savings both directly by decreasing cost of room and board and indirectly by increasing patient turnover. Further pharmacoeconomic studies are warranted to validate these results and to determine the cost-benefit of substituting dexmedetomidine in other cardiothoracic or critically ill populations.

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**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Clinical and economical evaluation of 17 hydroxyprogesterone caproate for the prevention of preterm labor in women with prior preterm labor and implications for the MassHealth budget

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**Purpose:** 17 hydroxyprogesterone caproate is the first drug in its class to be approved for the prevention of preterm labor. It had previously been used as the generic 17-hydroxyprogesterone caproate for years until it was withdrawn from the market due to not meeting quality control standards from the FDA. Some studies have shown that giving a pregnant woman a progesterone such as 17 alpha hydroxyprogesterone (17P) during pregnancy will decrease her chances of having a preterm birth. Since it is now branded, we are looking into the costs associated with this drug and if there is a greater benefit from using the drug or not.

**Methods:** A literature review of both the clinical and economic literature from 2000 to 2012 was conducted using PubMed. A budget impact analysis was implemented to compare costs from the perspective of MassHealth, a state health insurance program for low-to-middle income residents.

**Results:** When looking at the clinical aspect of this drug, 17P proved effective in reducing the rate of preterm delivery in singleton pregnancies in women who were high risk. The adjusted relative risk of delivery before 37 weeks of gestation in the 17P group compared with the placebo group was 0.70 (95% CI, 0.57 to 0.85). When comparing reconstituted 17P with branded Makena, there was a financial benefit to using the reconstituted project. It was shown to decrease the amount of preterm labor while decreasing the number of days a child spends in the neonatal intensive care unit. MassHealth reimburses an institution \$1,850 per day for an infant in the NICU. The base case scenario for our budget was the current standard of care, which is to let the birth occur without additional intervention. The use of the significantly lower cost compounded version (\$13 per injection) compared with Makena (\$1,440 per injection) provides better cost savings. Using the reconstituted version of the drug can save \$4 billion annually for the 1100 infants born under the provision of MassHealth. The effectiveness for the reconstituted 17P was based on the potency of each injection. It can vary between across institutions, which was the reason the product was removed from the market and likely the motivation for development of a branded product.

**Conclusion:** For some the high cost of Makena would be worth it, but from this payer's perspective, its high cost fails to justify its use, especially when a lower cost compounded option is possible. If steps are taken to ensure a more consistent final compounded 17P and more stringent quality controls for compounding, there would be greater potential cost savings than can be seen with the branded 17P, Makena.

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**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Clinical and economic evaluation of riluzole for amyotrophic lateral sclerosis (ALS) with implications for the Veterans Administration budget

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**Purpose:** Riluzole is the only FDA-approved medication for amyotrophic lateral sclerosis (ALS). Riluzole has been shown to prolong life in patients with ALS by 2-3 months; however it does not show symptomatic improvement. The purpose of this study was to review the clinical and economic evidence and evaluate the impact of riluzole on the Veterans Health Administrations 2011 budget. The incidence of ALS in veterans is 60% higher than in the general population.

**Methods:** A literature search was performed for clinical and economic studies of riluzole in the treatment of ALS. The analysis of the budget impact included sensitivity analyses related to the incidence, impact of treatment, and costs of riluzole associated with ALS.

**Results:** A total of 9 clinical studies and 4 economic studies were analyzed. Clinical evidence showed riluzole was effective at increasing survival by 2-3 months keeping patients in a more moderately affective health state versus placebo treated patients. However, it is unclear whether mortality benefits occur in early or advanced disease. Economic evidence suggested that riluzole showed favorable benefit over cost in earlier disease. For the base case, riluzole cost an additional \$674/month to the \$2,260/month of supportive care delivered to 1,010 veterans with ALS with a life expectancy of 36 months and an average increased survival of 3 months from treatment. Total additional cost of riluzole was \$10.6 million annually or 0.019% of the VA budget. The annual cost ranged from \$8.5 to \$12.7 million when survival ranged from an additional 1 to 5 months. With a higher prevalence of 1,233 veterans, annual cost of riluzole increased to approximately \$19.5 million. A lower prevalence of 987 veterans decreased riluzole costs to \$9.7 million/year. An increased life expectancy of 48 months raised annual riluzole costs to approximately \$13.1 million/year. A shorter life expectancy of 24 months decreased annual riluzole costs to approximately \$8.1 million/year. A more conservative estimate of supportive care costs at \$3,000/month yielded annual riluzole costs to be \$10.9 million. A high estimate of supportive care at \$16,667/month increased riluzole costs to \$23.7 million/year.

**Conclusion:** These incremental costs of riluzole treatment are similar to other incremental costs of treating terminally ill patients for similar survival benefits. Keeping riluzole on the formulary is appropriate given that the yearly treatment cost of riluzole is a small percentage of the overall VAs budget and due to the increased number of veterans diagnosed with ALS compared to the general public. Future studies should focus on initiation of riluzole in different stages of ALS and its impact on the budget.

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**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Hemoglobin and darbepoetin alfa dosing trends in hospital-based dialysis centers: 2010-2011

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**Purpose:** In January 2011, the Centers for Medicare and Medicaid Services (CMS) implemented the End-Stage Renal Disease Prospective Payment System (ESRD PPS) to manage health resource utilization and costs for outpatient dialysis care, as well as the Quality Incentive Program (QIP) to prevent any potentially negative consequences of the ESRD PPS on the quality of patient care. In addition, in June-July 2011, CMS proposed removing the lower-bound hemoglobin (Hb) metric of the QIP, and the prescribing information for the erythropoiesis stimulating agents (ESAs) was updated. Given these important events, this analysis describes trends in Hb levels and darbepoetin alfa dosing at hospital-based dialysis centers (HBDCs) from 2010 through 2011.

**Methods:** Cross-sectional analyses of ~6,900 hemodialysis patients ( $\geq 18$  years old,  $\geq 1$  Hb value, and  $\geq 1$  ESA dose) in 59 US-based HBDCs with a particularly branded electronic medical records (EMR) system were conducted at regular intervals from January 2010 to December 2011. The distribution of patients with mean Hb  $< 10$  and  $> 12$  g/dL were examined every month. Mean and median intravenous (IV) darbepoetin alfa dose per administration and mean cumulative IV darbepoetin alfa dose were computed every 4 weeks.

**Results:** Patients had a mean (SD) age of 62 (15) years, 47% were Caucasian and 13% African American, and 65% of patients had history of hypertension and 39% of diabetes. From January 2010 to January 2011, more patients had mean monthly Hb  $< 10$  g/dL, increasing from 12% to 14%; fewer patients had mean monthly Hb  $> 12$  g/dL, decreasing from 30% to 22%; the mean (SD) IV darbepoetin alfa dose per administration steadily declined 15%, from 71 (55) mcg to 61 (47) mcg (median (IQR): 52 (30,100) mcg to 40 (25,75) mcg); and the mean (SD) 4-week cumulative IV darbepoetin alfa dose declined 16%, from 227 (206) mcg to 190 (188) mcg (median (IQR): 160 (80,300) mcg to 125 (65,240) mcg). The shifts in Hb distribution continued into June 2011, as the percentage of patients with Hb  $< 10$  g/dL increased to 16% and the percentage of patients with Hb  $> 12$  g/dL decreased to 18%; the mean (SD) IV darbepoetin alfa dose per administration declined slightly to 59 (45) mcg (median (IQR): 40 (25,75)mcg); and the mean (SD) 4-week cumulative IV darbepoetin alfa dose increased slightly to 192 (178) mcg (median (IQR): 132 (75,240) mcg). From June 2011 to December 2011, the percentage of

patients with Hb <10 g/dL increased to 20% and the percentage of patients with Hb >12 g/dL decreased to 14%; the mean (SD) IV darbepoetin alfa dose per administration declined 6%, to 56 (44) mcg (median (IQR): 40 (25,75) mcg); the mean (SD) 4-week cumulative IV darbepoetin alfa dose declined 7%, to 178 (175) mcg (median (IQR): 115 (60,240) mcg). Overall, from January 2010 to December 2011, the percentage of patients with Hb <10 g/dL increased 8% points and the percentage of patients with Hb >12 g/dL decreased 16% points; and both the mean IV darbepoetin alfa dose per administration and mean 4-week cumulative dose declined 22%.

**Conclusion:** During the two-year period between 2010 and 2011, more patients had Hb <10 g/dL and fewer had Hb >12 g/dL. Darbepoetin alfa dosing declined in 2010 prior to ESRD PPS and QIP implementation, and again after ESA prescribing information were updated and CMS proposed changes to the QIP metrics. In response to key changes in ESRD reimbursement and health policy as well as ESA prescribing information, HBDCs have significantly modified anemia management practices, with reductions in Hb levels and darbepoetin alfa utilization.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Pharmacoeconomic evaluation of transplant-related cytomegalovirus hyperimmune globulin use at a large academic medical center

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**Purpose:** Cytomegalovirus (CMV) hyperimmune globulin (CMVIG, Cytogam, CSL Behring, King of Prussia PA) is FDA labeled for the prophylaxis of CMV infection associated with solid organ transplantation. CMVIG is commonly used, in conjunction with plasmapheresis, for its immunomodulatory properties by transplantation programs throughout the world. Conventional total intravenous immunoglobulins (IVIg) manifest similar immunomodulatory properties and are also used in an analogous fashion to CMVIG. The relative cost of CMVIG is greater than that of conventional IVIg. Thus, we performed a single-center retrospective chart review to characterize the prescribing patterns, uses, dosing, adverse effects, and cost of CMVIG at our institution. We also sought to project potential cost savings if a transition from CMVIG to IVIg was undertaken for immunomodulatory uses.

**Methods:** This analysis was approved by the Johns Hopkins University Institutional Review Board. Transplant patients were identified through a billing database utilizing ICD-9 codes. Of the 214 patients screened, 205 adult and pediatric inpatients who received CMVIG from January 1, 2010 to December 31, 2011 were reviewed. Patients were excluded if their treatment course overlapped from 2009 into 2010 or from 2011 to 2012. The following patient variables were collected from the electronic medical record: age at first CMVIG dose, gender, weight at first CMVIG dose, ethnicity, type of transplant, CMVIG indication and dosing. A treatment course was deemed completed when >14 days lapsed between the last dose of one course and the start of another. Current institutional cost was used for cost estimates. Descriptive statistics were used for data analysis.

**Results:** 190 adult patients with mean age of 47 (SD 14) years and 15 pediatric patients aged 7.5 (SD 5) years were included. Females represented half of adults and 33% of pediatrics. Male adults weighed a median of 87 (IQR 35) kg and female adults 69 (IQR 26) kg. Pediatric males weighed a median of 26 (IQR 25) kg and pediatric females 12 (IQR 15) kg. Caucasians represented 58% of adults and 53% of pediatrics. Of these, 169 (89%) adult and 7 (47%) pediatric patients had undergone kidney transplantation, 9 (5%) adult and 1 (7%) pediatric hematopoietic stem cells, 3 (2%) adult and 3 (20%) pediatric livers, 3 (2%) adult

kidney/pancreas, 2 (1%) adult kidney/liver, 2 (1%) adult lung, 1 (0.5%) adult and 3 (20%) pediatric hearts, and 1 (0.5%) adult and 1 pediatric (7%) have not yet been transplanted. Immunomodulatory uses accounted for 85% of adult and 53% of pediatric doses. Desensitization prior to transplantation and antibody mediated rejection (AMR) predominated with 42%, 39% of adults and 20%, 27% of pediatric doses, respectively. CMV uses including prophylaxis and treatment of viremia or disease accounted for 15% of adult and 47% of pediatric doses. Median CMVIG dose for CMV and immunomodulatory uses was 136 (IQR 46) mg/kg, 100 (IQR 10) mg/kg in adults, and 147 (IQR 126) mg/kg, 103 (IQR 8) mg/kg in pediatrics, respectively. Total CMVIG cost for the study period was \$4.79 million. Immunomodulatory uses cost \$4.14 million and CMV uses cost \$0.65 million. Maximal cost savings was projected at 81.6% (\$3.38 million) if CMVIG was switched to conventional IVIG (at 1:1 dosing) for immunomodulatory uses over the study period. Savings were projected to be negligible for CMV uses.

**Conclusion:** CMVIG is primarily used for its immunomodulatory properties at our institution. Conversion to a conventional IVIG product for immunomodulatory uses may result in up to 81.6% cost savings. Outcomes of interest, such as desensitization and AMR efficacy, will be tracked and compared after the transition from CMVIG to IVIG as cost savings may be enhanced or squandered if these are not similarly efficacious.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Economic impact of common canister forms of inhaled anticholinergic treatments

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**Purpose:** Inhaled anticholinergic therapies are standard options in treatment and maintenance of chronic obstructive pulmonary disorders (COPD). The institutional package size containing five doses generally exceeds the number of doses required for the average length of stay for the patient with COPD. Consequently, this leads to waste when the inhaler is disposed upon discharge. Common canister protocols have been in use at hospitals for several years and have been shown to reduce waste. Since tiotropium is not compatible with a common canister protocol administration, utilization of short-acting ipratropium is projected to yield cost savings through decreased waste. It is important to evaluate the economic impact of programs to determine feasibility.

**Methods:** This study was approved by the appropriate ethics committee or institutional review board and informed consent was waived. Patients who were ordered tiotropium therapy from January 2012 through April 2012 were identified using the pharmacy computer system. The records of each patient were reviewed and data were collected including age, gender, prescriber, indication for use, whether the medication was initiated in the emergency department, whether the medication was a medication from home, treatment start date, treatment stop date, the number of doses dispensed, and number of doses charted on the medication administration record (MAR). Calculations were completed for the monthly values for the total number of patients, the total number of doses dispensed, the total number of doses charted on the MAR, the percentage of dispensed doses administered, the average number of doses dispensed per patient encounter, the total number of wasted doses, the number of patients receiving one or zero doses, and the cost for wasted doses. Also the totals for the five-month period were calculated for each of these parameters. The number of doses and costs for tiotropium therapy were compared to ipratropium therapy administered as two puffs three times daily via a common canister.

**Results:** The monthly number of patients for January through April was 55, 50, 38, and 40 respectively. The monthly number of doses dispensed was 370, 315, 215, and 215 respectively. The monthly number of doses charted on the MAR was 177, 140, 81, and 124 respectively. The monthly average number of doses dispensed per patient encounter was 6.73, 6.3, 5.66, and 5.38 respectively. The monthly number of wasted doses was 193, 175, 134, and 91 respectively. The total cost of the wasted doses during the January through April time frame was greater than \$8500. The monthly number of doses of ipratropium therapy during this time would be 1062,

840, 486, and 744 respectively. Monthly cost savings utilizing the common canister ipratropium therapy would be \$4537.88, \$3924.90, \$2762.74, and \$2515.06 respectively. Total cost savings for January through April would be \$13740.58.

**Conclusion:** Wasted medication doses are an important source of excess costs in this hospital. Frequently fewer than half of the dispensed doses of inhaled tiotropium were administered to patients prior to discharge. A common canister protocol will significantly reduce medication waste and hospital costs.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Cost Effectiveness of Rivaroxaban Compared with Warfarin and Dabigatran for Stroke Prevention in Moderate-to-High Risk Nonvalvular Atrial Fibrillation Patients

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**Purpose:** Stroke is a major complication of nonvalvular atrial fibrillation (A-fib), but it can be prevented in many patients with the use of anticoagulants. Warfarin is the mainstay of oral therapy, but novel agents such as dabigatran, an oral, twice-daily direct thrombin inhibitor, and rivaroxaban, an oral, once-daily factor Xa inhibitor, offer less monitoring and noninferior safety. The purpose of this study is to estimate the quality-adjusted survival, costs, and cost-effectiveness of rivaroxaban compared with warfarin and dabigatran for preventing ischemic stroke in moderate-to-high risk patients with nonvalvular AF.

**Methods:** A Markov decision model was constructed in order to compare the cost-effectiveness from a payers perspective of 20 mg once-daily rivaroxaban to warfarin, dose-adjusted to an international normalized ratio (INR) of 2-3, and 75 mg twice-daily dabigatran. Event-rate data were obtained from both the Randomized Evaluation of Long-Term Therapy (RE-LY) trial, comparing dabigatran with warfarin for stroke prophylaxis in A-fib patients, and the Rivaroxaban Once Daily Oral Direct Factor Xa Inhibitor Compared with Vitamin K Antagonism for Prevention of Stroke and Embolism Trial in Atrial Fibrillation (ROCKET-AF). Utility estimates were collected from previously published cost effectiveness studies and drug costs were estimated on the basis of wholesale acquisition cost (WAC). One-way sensitivity analyses were completed on all model variables across their plausible range of values based on 95% confidence intervals. Both first and second order Monte Carlo simulations were performed with the probabilistic analysis sampling all variables across beta distributions. The model target population represents individuals 65 years or older with non-valvular A-fib who are at moderate-to-high risk for stroke, as indicated by a CHADS2 score  $\geq 2$  or equivalent.

**Results:** According to base case conditions, the quality-adjusted life expectancy associated with warfarin was 8.99 QALYs, dabigatran was 10.81 QALYs, and rivaroxaban was 9.14 QALYs. The total costs of each drug over the model time period, 35 years or death, were \$139,107 for warfarin, \$103,212 for dabigatran, and \$139,145 for rivaroxaban. Dabigatran dominated both warfarin and rivaroxaban given its lower costs and better outcomes as measured by QALYs. One-way sensitivity analyses across the plausible ranges of all event probabilities and utilities

showed that no single variable substantially affected or changed the cost-effectiveness results; however, the most heavily influential variable for each treatment arm was the probability of stroke. In the probabilistic sensitivity analysis, when all variables were simultaneously dynamic, dabigatran proved to be cost-effective compared to warfarin and rivaroxaban in 100% of all iterations using a willingness to pay threshold of \$10,000/QALY, \$50,000/QALY, and \$100,000/QALY even when it was not dominant.

**Conclusion:** Limitations of this analysis include the utility assumptions used for rivaroxaban and dabigatran and a maximum number of two events that could occur per year. There are no published data regarding the quality-of-life or utility associated with rivaroxaban use in a healthy state; therefore, the model assumes equal utility between dabigatran and rivaroxaban. The utilities of dabigatran and rivaroxaban were based upon previously published estimates of ximelagatran, a direct thrombin inhibitor not approved for use in the US. Additionally, the model only allows for a maximum of two events per year, which is a potential underestimation of possible event frequency. This assumption may have resulted in an overestimation of treatment utility with an underestimation of total treatment costs. The limitations of this study can provide guidance for future research into the cost effectiveness of rivaroxaban relative to alternative therapies. Future studies may have access to more accurate utility estimates for both dabigatran and rivaroxaban, which could provide for a more telling analysis. In addition, future analyses may forgo entirely the controversial use of utility scores and instead focus on a less contentious outcome, such as cost per stroke averted. Based on the results of this analysis, for patients with nonvalvular AF age 65 years or older who are at increased risk of stroke, dabigatran is a cost-effective prophylactic option compared to both warfarin and rivaroxaban across a range of scenarios when a QALY is the outcome measure.

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**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Improving health care literacy awareness and empathy among pharmacy students through a health literacy gap academic assignment.

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**Purpose:** Providing health literacy education to pharmacy students is part of the Accreditation Council of Pharmacy Education (ACPE) standards. This is an important social topic that is necessary for students to embrace to become effective health care providers. Incorporating health care literacy into the curriculum is necessary before students start their experiential education and enter health care systems. The primary objective is to assure that pharmacy students, prior to their Introductory Pharmacy Practice Experiences, are aware of the lack of health care literacy in the general public. The secondary objective is to assess the ability of an active learning health care literacy assignment to create a better understanding of and empathy towards lower health care literacy patients.

**Methods:** UF students are enrolled into a required Professional Practice Development course that is coordinated by an instructor in the experiential program. The course is taught the semester prior to the start of the professional program and covers a variety of introductory topics such as: cultural competency, health care disparities, internship requirements, and health care literacy. An active learning activity was developed in this course to promote pro-social understanding and decision making, thus creating a stronger sense of patient empathy. The exercise for teaching students to empathize with patients was accomplished by creating an academic situation where students were assigned a reading over a neuro-pharmacy topic prior to class. Students were asked to review the article and prepare for discussion during the next scheduled class. When students attended class they were asked if they had any questions regarding the article and then after this opportunity they were given a ten question quiz. This created a sense of frustration and disappointment as many students did not understand the material they had read nor did they know what appropriate questions to ask to clarify the material. Students then reflected on the difficulty of the assignment, the feelings that were generated toward the material and the instructor and were challenged to relate their experience to that of a future patient interpreting health information.

**Results:** Overall student awareness and interest in health care literacy improved. This outcome was demonstrated through a survey that was administered to the students. Over 80% of the students recognized that they didnt comprehend the material from the assigned reading. As a result of their quiz scores from the assigned reading, over 70% of the students realized they were

not able to apply the information they read and recognized a health care literacy gap. Over 90% of students as a result of this course and the learning activity would integrate modified health care plans to compensate for patients with low health care literacy. Students were most likely to use visual aids, lower literacy level counseling material, use a repeat back method to verify understanding and ask open ended questions to close gaps in health literacy of their patients.

**Conclusion:** This assignment has been successful in teaching students to recognize the health literacy gap between caregivers and patients. Furthermore this assignment may better equip students to apply appropriate counseling methods when talking to patients within various health care systems.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Who, what, where, and how? Preparing student pharmacists for health fairs

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**Purpose:** Health fairs provide valuable opportunities for student pharmacists to interact with patients early in their pharmacy education. With the implementation of Introductory Pharmacy Practice Experience (IPPE), there is a greater emphasis on pharmacy schools exposing student pharmacists to patient interactions under their guidance and for student pharmacists to develop health-screening and communication skills prior to IPPE. Hands-on experience, which is available through participation in health fairs, can enhance learning about associated disease states. Multiple student pharmacist organizations provide various health screening opportunities, yet an overall summary of the types of services provided and the training methodology has not been evaluated or characterized. There is currently no standard of practice in regards to training students for health fairs nor are there descriptions of training currently present in the literature. This type of data would help streamline the training process and prepare students to provide these services at health fairs. The data presented here is part of a larger study evaluating the student pharmacists' experiences at health fairs. The objectives of this study are determining 1) where student pharmacists receive their training, 2) if they feel that their training prepared them for health fairs, 3) their roles at health fairs, and 4) how many of them participated in an ethnic-predominant health fair. The results may guide the direction of future training of student pharmacists to better prepare them for health fairs.

**Methods:** Student pharmacists in the Classes of 2013, 2014, and 2015 completed an online survey. They were asked to rank a series of questions with a designation of 1 to 5 with 1 being strongly disagree, 2 being disagree, 3 being neither agree or disagree, 4 being agree, and 5 being strongly agree. Additionally, there were background questions in order to provide information on their activities at health fairs. The survey was anonymous.

**Results:** A total of 356 students ranging from first-year to third-year student pharmacists were surveyed. On average, each student pharmacist participated in two health fairs a year. The percentage of time spent on various services at these health fairs included: blood glucose monitoring (21%), blood pressure monitoring (17%), patient education (15%), administrative work (13%), Medicare Part-D counseling (8%), immunizations (5%), medication counseling or brown bagging (4%), and cholesterol screenings (4%). Approximately 37% of the health fairs were attended primarily by a particular ethnicity with Hispanic (30%) and Vietnamese (22%)

populations being the most common ethnicities served. In these ethnic-dominant health fairs, student pharmacists felt comfortable communicating with these patients (83% agreed or strongly agreed) and providing healthcare services to these patients (88% agreed or strongly agreed). Student pharmacists received training from the classroom (46%), student pharmacist organizations (8%), both (43%), or other (3%). Those surveyed agreed or strongly agreed that classroom (78%) and student organizations (60%) provided adequate preparation. Student pharmacists agreed or strongly agreed (79%) that they received adequate supervision during the health fairs.

**Conclusion:** The results provided valuable information regarding the characterization of student pharmacist training and roles during health fairs. The average student pharmacist participated in two health fairs a year and performed a variety of functions. Most of them felt adequately prepared to provide healthcare services to patients. However, classroom and student pharmacist organization training could still be improved to better prepare student pharmacists for providing services. The most common services provided were blood glucose and blood pressure screenings. In contrast, fewer student pharmacists had experience in Medicare Part-D counseling, immunizations, medication counseling, and cholesterol screenings. Thus, this is an opportunity to increase student pharmacists' experience with these lesser-participated services to offer a more diverse clinical experience. More than one-third of the health fairs served ethnic-predominant populations. These results will be disseminated to all student pharmacist organizations to provide feedback for planning future health fairs and guidance when training student pharmacists to better serve both the patients. Additionally, preceptors may also be trained to provide better guidance for student pharmacists during health fairs including but not limited to increased teaching through example and solidification of disease state knowledge. Future studies include assessing patient satisfaction and the impact of these healthcare services provided by the student pharmacists.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Clinical and economic evaluation of indacaterol maleate for moderate to severe COPD patients with implications on the MassHealth budget

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**Purpose:** Chronic obstructive pulmonary disorder (COPD) is a progressive condition which affects nearly 12 million adults in the United States at a total estimated annual cost of 49.9 billion USD. Many patients with COPD are burdened with complicated medication regimens which require frequent administration. Available clinical evidence suggests that indacaterol, a novel ultra-long-acting beta2-agonist, is safer and more effective than current alternatives . The purpose of this research was to conduct a clinical and economic evaluation of indacaterol to influence a formulary decision for the treatment of moderate to severe COPD.

**Methods:** Clinical study searches were performed using PubMed and EBSCOhost. Search Terms included “indacaterol” AND “COPD”. Limits included English, Clinical Trials, and human subjects. The search identified 622 studies. Only studies which pertained to the efficacy and safety of indacaterol were considered for clinical evaluation. The general search terms: “indacaterol” AND (“cost\*” OR “econ\*”) were used in PubMed and EBSCOhost to conduct the search for economic evidence. This search resulted in 20 studies limited to the English language and that contained information relevant to the cost of indacaterol use in patients with COPD. A budget impact analysis was performed from the perspective of the MassHealth payer, and compared indacaterol to tiotropium, salmeterol, and formoterol as the maintenance bronchodilator per the treatment algorithm provided by the 2012 GOLD guidelines. Average wholesale costs and rates and costs of hospitalization were utilized to compare annual costs associated with each bronchodilator therapy. Hospitalization rates were adjusted for variations in adherence between medications with different dosing frequencies. Sensitivity analyses were performed to account for uncertainties in how indacaterol would be integrated into the current standard of care, and to determine how heavily the hospitalization rate influenced the budget impact of indacaterol.

**Results:** Based on available clinical evidence, indacaterol was shown to be more effective in raising FEV1 compared to tiotropium, salmeterol, and formoterol, at 24 hours post dose as well as after 12 weeks of therapy. The economic analysis suggest that there is a financial benefit to using indacaterol compared to the other treatment options for management of patients with moderate to severe COPD. Despite omitting certain costs associated with the treatment of COPD

which were likely to be consistent among each treatment, the budget impact analysis demonstrated that the use of indacaterol would reduce overall cost of treatment for the MassHealth payer. The analysis revealed that the addition of indacaterol to the MassHealth formulary would likely result in cost-savings of nearly 300 USD per patient per year. A sensitivity analysis concluded that as long as the hospitalization rate for patients on indacaterol remained under 8.44 percent, indacaterol would be economically advantageous. Additionally, if only patients on tiotropium switched to indacaterol, savings would be enhanced; whereas if only patients on salmeterol or formoterol switched to indacaterol, costs would increase. Excluding extreme situations, when applied to the typical COPD patient population, the addition of indacaterol would be would have a favorable impact on the MassHealth budget.

**Conclusion:** COPD is a chronic condition which affects millions of adults in the United States. The disease is associated with substantial costs, including those associated with chronic maintenance as well as those related to the acute treatment of exacerbations. Based on the analysis of available clinical and economic evidence, indacaterol consistently provided statistically significant reductions in COPD-related morbidity at lower costs. The budget impact analysis demonstrates that indacaterol may be a favorable alternative to the current preferred treatment according to the MassHealth formulary as increases in its use would lead to substantial cost-savings.

**5-164**

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Financial Impact of Lean Process Improvement on Targeted Drugs in the Oncology Population in an Academic Medical Center

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**Purpose:** The core idea of lean process is to optimize patient care with maximal utilization of resources. We describe the financial impact of lean process improvement on twenty key drugs in the outpatient settings in our academic health care system.

**Methods:** All stakeholders including pharmacists, physicians, nurses, clerical staff, laboratory personnel and hospital administration participated in the lean process to revamp our care delivery process for oncology patients. The current and future states were identified based on the input from the stakeholders. Areas for improvement included revamping of patient scheduling, laboratory testing, evidence based therapy, standardization of care, safe use of medications and prior authorization process. An oncology pharmacy and therapeutics (P&T) subcommittee was also formed under the P&T committee. The group met on a regular basis and progresses were monitored. Pharmacy was instrumental in analyzing literature to establish evidence based disease management protocols and they were used in the outpatient infusion centers. Oncology P&T subcommittee selected twenty agents for monitoring compliance to evidence based therapy protocols. The subcommittee reviewed the utilization of the agent every month and actions were taken if any variance were noted.

**Results:** The targeted drugs had forty four percent cost reduction in the last fiscal year compared to the previous one with a resultant cost savings of \$525,000. The same trend is continuing in the current fiscal year.

**Conclusion:** Our results demonstrate that a multi-disciplinary team led lean initiative can lead to significant cost savings. We believe that the ownership by the stakeholders helped us to implement standardized disease management and achieve the savings.

**Category:** Practice Research / Outcomes Research / Pharmacoeconomics

**Title:** Pens or syringes? A time savings evaluation

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**Purpose:** Preparing insulin doses is a time-consuming task for those assisting with patient care. Patients requiring rapid acting insulin for prandial coverage may require 4 doses in a 12 hour period and more if corrections are required. Simplifying preparation with prefilled pens saves time that can be reallocated for more meaningful functions. Syringes and vials are conventionally used in institutional settings and some departments are considering a switch to pen devices. We aimed to measure and evaluate the time required to prepare and administer a sequence of simulated doses using conventional syringes and prefilled pens.

**Methods:** A controlled simulation was established consisting of a medical order station, a supply room, a patient room, and a mock patient for injection. A series of doses were generated using randomization and allocated (1 to 1 ratio) to pen or syringe based delivery. A standardized protocol was followed that included a review of the insulin order, preparation of an insulin dose and delivery to the mock patient. Prefilled Novolog demonstration FlexPens were used to prepare mock insulin doses and were assembled and dialed to the appropriate amount following each new medication order. Similarly, BD insulin syringes and vials were used and assembled following each new medication order. Vials were sterilized with alcohol wipes prior to each medication withdrawal and bubbles were removed from syringes prior to administration. The mock injection site was sterilized and pressure was applied to the site for three seconds following administration. Two operators administered 130 doses independently by pen (n equals 58) and syringe (n equals 72) and were timed from the receipt of the medication order until the end of insulin administration.

**Results:** The mean time difference between pen and syringe based administration was 19.9 seconds (95 percent CI 17.3-22.6, p less than 0.0001). Both operators demonstrated similar administration time with pens and syringes (p equals 0.85) without differences in volume administered between operators (p equals 0.71). Operators became faster as the injection sequence progressed suggesting a training effect. Administration time data was divided into quartiles (Q1-Q4) to evaluate the training effect. Q1-Q3 each had 32 doses and Q4 had 34. The mean reduction in administration time between each quartile was as follows: Q1-Q2 equals 5.44 seconds (95 percent CI 0.65-10.2, p equals 0.026); Q2-Q3 equals 5.61 seconds (95 percent CI 0.82-10.39, p equals 0.022); and Q3-Q4 equals 4.78 seconds (95 percent CI 0.69-9.50, p equals 0.047). No significant difference in administration volume was observed between quartiles.

**Conclusion:** These data suggest a 28 percent reduction in insulin preparation time when using a prefilled insulin pens. The reduction in preparation time was independent of the operator or administration volume and remained consistent throughout the sequence after adjusting for the training effect. A mean 19.9 seconds saved per administration saves minutes over a shift and hours during a month that be recouped for other value-added activity. Implementing efficient practices can unlock valuable time for providers. The economics of this question should be evaluated at an institutional level knowing that the costs and benefits are likely to be incurred by different departments and budget lines.

**5-168**

**Category:** Preceptor Skills

**Title:** A Novel Approach to Integrating Advanced Pharmacy Practice Experience Rotations in Emergency and Internal Medicine

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**Purpose:** Determine the value of the Acute Care Conference (ACC) from the perspective of student participants and to describe the ACC as a method of integrating formalized education of internal medicine and emergency medicine students during advanced pharmacy practice experiences.

**Methods:** After approval from the Institutional Review Board, an electronic survey was sent to all students who participated in the ACC from September 5, 2011 to April 20, 2012. While completing advanced pharmacy practice experiences in internal medicine or emergency medicine, students reported to the School of Pharmacy on three Fridays for the ACC. Faculty from the School of Pharmacy, who were also preceptors for the students, conducted the ACC. An electronic survey was created in an internet based survey program. A hyperlink was sent via electronic mail to all students who took part in the ACC. The link was made available for nearly three weeks and periodic reminders were sent to all students encouraging completion of the survey. The survey consisted of six questions directly related to the content and delivery of the ACC. Students were asked to rate their level of agreement on a 5-point Likert scale for the six questions. In addition, students were asked to categorize their age, previous work experience, gender, highest degree earned, and career plans after graduation. Descriptive statistics were used for all data elements.

**Results:** Twenty-two students took part in the ACC during the aforementioned timeframe. Overall, there was an 86.4% response rate to the survey. The median score (possible scores 1-5; 1=strongly disagree, 5=strongly agree) and questions asked in the survey were the following: I learned new pharmacotherapy content and principles, median 5; The topics covered in the ACC assisted in my understanding of concepts related to patient care, median 5; I am more interested/excited about incorporating clinical activities in my future pharmacy practice as a result of the ACC, median 5; The format of the ACC was conducive to learning pharmacotherapy concepts, median 5; I feel that the content of the ACC will assist me on future advanced pharmacy practice experiences, median 5; The topics covered during the ACC assisted me in understanding the transition in patient care from the emergency department to the inpatient environment, median 5. Fifteen respondents were aged 21-29 years and the remaining four were aged 30-39 years. The majority of respondents were female (73.7%), had earned a bachelors degree prior to pharmacy school (63.2%), had work experience in the retail setting (63.2%), and plan to work in the retail setting (52.6%).

**Conclusion:** The ACC was well received and was an effective means of formalized training for pharmacy students taking internal medicine and emergency medicine advanced pharmacy practice experiences. The conference should continue and may serve as a model to ensure core topics are discussed in an integrated fashion.

**Category:** Preceptor Skills

**Title:** Survey assessment of pharmacy resident and preceptor perceptions of feedback

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**Purpose:** Residency preceptor development continues to be a priority for American Society of Health-System Pharmacists (ASHP) members involved in residency training programs. The summary reports from ASHP accreditation surveys over the last two years indicate that one of the top areas for partial compliance with PGY1 programs is preceptors do not adequately provide criteria-based feedback. A literature search on this issue identifies a lack of information specific to pharmacy resident feedback. This project was designed to uncover differences and similarities in perceptions of feedback received or obtained during the residency year from preceptors and residents.

**Methods:** Surveys were designed for both preceptors and residents to determine the overall perception of timeliness, effectiveness and quality of feedback. Prior to distribution, the survey was reviewed and edited by leaders within ASHP. The survey was emailed to all 2011-2012 residency program directors through a distribution list provided by ASHP. A letter was included describing the purpose and requesting program directors forward the survey to all preceptors and residents within their program. Each individual survey link was open for two weeks and only allowed participants to access the survey once for completion.

**Results:** A total of 1,030 preceptors and 425 residents completed the survey. Overall quality of constructive feedback given or received was rated as good or better in 80 percent (828 out of 1030) of preceptors and 65 percent (276 out of 425) of residents (p equals 0.8). Overall quality of feedback given or received regarding clinical knowledge was rated good or better in 72 percent (738 out of 1030) of preceptors and 65 percent (276 out of 425) of residents (p equals 0.8). Preceptors felt that they initiated feedback 83 percent of the time while 50 percent of residents felt that they initiated feedback at the same rate as their preceptors (p less than 0.05). Lastly, preceptors indicated that the main barriers to providing criteria-based feedback were time constraints (72 percent), perceived lack of skill (21 percent) and inability to provide it in a private area (21 percent).

**Conclusion:** The survey assessment identified current perceptions, most importantly the strengths and deficits, of criteria-based feedback in pharmacy residency programs. The survey allowed critical evaluation of specific areas that need improvement, as well as defined specific areas of research that are needed on criteria-based feedback education and methodology.

5-170

**Category:** Preceptor Skills

**Title:** Development of a pharmacy-school affiliated longitudinal advanced pharmaceutical practice experience at a large academic institution

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**Purpose:** Baystate Medical Center (BMC) is the flagship 658-bed academic medical center in a three-hospital health system. BMC currently accepts more than 150 students from five affiliated local colleges of pharmacy into introductory and advanced education experiences. A longitudinal advanced pharmacy practice experience (APPE) program was designed to provide highly motivated students with a unique opportunity to complete their experiential education requirements at one organization. Massachusetts College of Pharmacy Worcester (MCPHS-W) faculty and BMC clinical staff worked together to design a 36-week APPE experience that would simulate a residency program and offer more opportunities for integration into a practice model.

**Methods:** Four MCPHS-W faculty hold practice sites at BMC and the department of pharmacy offers nine unique APPEs including community (outpatient pharmacy), ambulatory care (heart failure and diabetes clinics), institutional (inpatient pharmacy), and multiple acute care options. Students were invited to apply to the program via MCPHS-W campus email. Interested students submitted a letter of intent, curriculum vitae, and transcripts were reviewed by a selection committee. Students were evaluated with a rubric similar to that used for the BMC residency application process. Selected students were then invited for an in-person interview with several members of the BMC pharmacy department and MCPHS-W faculty. Interviewees were also evaluated via a rubric similar to that of the BMC residency selection process. Each student would be expected to complete all six rotations (4 required, 2 elective) throughout various BMC/MCPHS faculty rotations. Additionally, each student was assigned to a PGY-1 pharmacy resident research project to act as a research assistant and participated in heart failure patient discharge counseling.

**Results:** Four students were selected to complete the longitudinal program during the 2011-2012 academic year. The four students successfully completed all six rotations at BMC. Approximately 100 heart failure patients were counseled by longitudinal students. The students co-authored seven posters presented at both regional and national meetings (4 residency project posters, 3 individual student posters). Two students presented five minute clinical pearl sessions at the Massachusetts Society for Health Systems Pharmacists annual meeting. Benefits to the

institution included consistent student involvement in underrepresented practice areas (e.g. patient discharge counseling) and residency project assistance. Benefits to the students included increased access to residents, faculty, and staff; increased insight into residency training; access to projects that would strengthen the pursuit of a residency; and a consistent practice site throughout the year. Of the four participating students, two applied to post-graduate residency programs and both successfully matched. Two participating students are continuing with research surrounding the longitudinal program.

**Conclusion:** The inclusion of an application and interview process was an important factor in the successful selection of motivated candidates for the longitudinal advanced pharmacy practice experience. Longitudinal APPE programs may represent a unique mechanism for colleges of pharmacy to secure practice sites for faculty members and students. The longitudinal student program created a consistent, yet flexible, learning environment for selected students and led to increased patient service, residency program assistance, and increased regional and national exposure through research projects. Similar types of programs may be considered as newer schools of pharmacy look to secure relationships with institutions for their faculty and students.

5-171

**Category:** Preceptor Skills

**Title:** Implementation of a faculty-precepted institutional advanced pharmacy practice experience at a large academic medical center

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**Purpose:** The Accreditation Council for Pharmacy Education (ACPE) standards requires an institutional advanced pharmacy practice experience (APPE) for all PharmD candidates. Institutional APPEs are typically precepted by adjunct faculty. With the growing number of pharmacy schools and the demands put on adjunct faculty, institutional APPEs are increasingly challenging to schedule and ensure quality experiences for students. The addition of faculty-precepted institutional APPEs as an option for students was established to address rotation demands, to present practice experiences desirable for faculty and to provide service to practice site partners. The purpose of this project is to describe the process involved with the establishment of and the corresponding benefits of a faculty precepted institutional APPE.

**Methods:** The need for additional institutional APPEs was established by the office of experiential education and a number of faculty expressed interest in this area for their practice sites. Discussions with the Department Chair and Dean of the School of Pharmacy occurred to identify potential healthcare institutions to partner with for institutional APPEs. Site selection criteria included proximity to campus, willingness of hospital pharmacy administration to enter into the arrangement and willingness to enter into an affiliation agreement. Meetings between the faculty member and hospital pharmacy administrators were conducted to identify mutually agreed upon faculty and student activities and responsibilities. The institutional APPE faculty member assumed the responsibility of developing a site specific APPE syllabus and calendar.

**Results:** Four faculty-precepted institutional APPEs over the course of five years have been established in hospital pharmacies ranging from 296 beds to 781 beds with a variety of patient populations. Initial collaboration between the faculty, department chair and hospital pharmacy administrators resulted in an affiliation agreement as well as identification of agreed upon faculty and student activities. Faculty have precepted an average of 18 students per year and some activities are standard while others are site specific. Examples of standard activities include the review of medication orders, national patient safety goals, USP 797 and diseases. Site specific activities include adverse drug event investigation, therapeutic drug monitoring, Pharmacy & Therapeutics committee participation and staff education.

**Conclusion:** Faculty precepted institutional APPEs are a positive addition to the required types of APPEs typically precepted by pharmacy practice faculty. Benefits of these APPEs include the following: 1) They provide structured learning and evaluative methods for students; 2) They increase institutional APPE availability; and 3) They provide service to practice site partners. Collaboration between the faculty and the site is essential to provide and maintain beneficial outcomes for the student, faculty and healthcare institution.

5-172

**Category:** Preceptor Skills

**Title:** Resident teaching certificate program at Roosevelt University College of Pharmacy

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**Purpose:** Roosevelt University College of Pharmacy implemented a Resident Teaching Certificate Program (RTCP) based on post-graduate residency standards recommended by The American Society of Health-System Pharmacists (ASHP). The College of Pharmacy has affiliated with institutions in the Chicagoland area to mentor residents practicing at institutions not affiliated with a Doctor of Pharmacy program. The RTCP requires classroom teaching and assessment of various skill sets in the advanced Pharmaceutical Care Labs. Graduates of our program also learn about educational methodology, teaching at the clinical site, and developing a teaching portfolio. Successful completion of this program equips residents to demonstrate the skills required to achieve proficiency in academia and institutional settings as faculty members and clinical preceptors.

**Methods:** Participating residents must complete several requirements in order to graduate with a certificate of completion. Residents are required to participate in ten one-hour seminar sessions facilitated by Roosevelt University College of Pharmacy faculty or institutional site preceptors on the following topics: Roles and Responsibilities in Academia, Designing a Syllabus and Developing Objectives, Writing a Teaching Philosophy and Effective Lecturing, Active Learning and Technology in the Classroom, Methods for Assessing Classroom Learning and Developing Test Questions, Collaboration and Coauthorship, Experiential Education, Interprofessional Education, Student and Peer Evaluation, and Academic Integrity and Copyright Issues. Residents must also complete at least three teaching experiences: design and deliver one 50-minute lecture to Doctor of Pharmacy students, prepare and deliver a 50-minute Accreditation Council of Pharmacy Education (ACPE) accredited continuing education program for pharmacists, and facilitate six assigned sessions of Pharmaceutical Care Labs. Residents also precept at least two Advanced Practice Pharmacy Experience (APPE) students; precepting of Introductory Pharmacy Practice Experience (IPPE) students is also recommended for participating residents. Each resident is assigned a faculty mentor from the College to guide the residents progress on campus, critique and provide constructive feedback on lecture and presentation skills. Residents are also assigned an institutional preceptor to guide residents progress at the institutional site, critique and provide constructive feedback on the continuing education program and precepting skills of the resident.

**Results:** During the residency year of 2011-12, three residents from two affiliated sites within the Chicagoland area successfully completed the RTCP. Five faculty members and two institutional preceptors facilitated and delivered the ten seminar sessions. Residents developed a syllabus template, prepared objectives and created assessment questions for the continuing education program, and constructed a teaching philosophy statement for inclusion into their teaching portfolio along with self, peer, faculty, preceptor, and student evaluations. The RTCP Coordinator acted as the only faculty mentor due to low resident enrollment, while each site had its own institutional preceptor. Low enrollment was attributed to the program being established in December 2011. Residents enrolled in January 2012 and completed the program in an accelerated, six-month time frame.

**Conclusion:** The Resident Teaching Certificate Program at Roosevelt University College of Pharmacy is an introductory and comprehensive program with requisite facilities to prepare pharmacy residents for a career in academic and clinical settings. Participants feedback indicated that Lab facilitation helped strengthen their communication skills. Experience in precepting IPPE/APPE students enabled them to set specific objectives, and develop their individual precepting and teaching styles. Participants indicated that the program gave them the tools necessary to develop a meaningful professional portfolio.

5-173

**Category:** Preceptor Skills

**Title:** Implementation of a clinical pharmacy career development course for P2 and P3 students interested in post-graduate residency training

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**Purpose:** As more pharmacy practitioners become involved in providing direct patient care, the need for residency-trained pharmacists will increase. Colleges of pharmacy have a responsibility to ensure that all pharmacy students are aware of the potential career options that residency training can allow. An elective course promoting clinical pharmacy career development (PHRD 5065) was offered for the first time at the College of Pharmacy in the fall of 2011. PHRD 5065 was designed to both aid students in deciding about post-graduate training and to help them be more competitive in the residency application process.

**Methods:** Topics covered included: career choices post-residency, making yourself competitive while in pharmacy school, what is a CV, PGY2 residencies, the Match, Midyear, PPS, Residency Showcase, scholarly activity, and CV and letter of intent development. There were no tests given in this course. However, 4 reflective statements were required as well as a CV, letter of intent, newsletter article, and a presentation on a residency program of their choice. Activities included: CV development and review, letter of intent development and review, and mock interviews. Several guest lecturers were incorporated to provide students with a look at real opportunities for jobs after post-graduate training. Guest speakers included: current PGY1 resident, previous PGY2 resident, entrepreneur, director of pharmacy, clinical pharmacist, and clinical faculty member. Students were given a survey on the first day of the course and the last day of the course to evaluate their interest in post-graduate training as well as their ability to complete various parts of the residency application process. Students were also required to turn in a reflective statement at the end of the course describing the most and least helpful parts of the course. In addition, students completed an anonymous survey via CreateSurvey after the course was over describing potential changes in the course. All surveys used were approved by the university's IRB.

**Results:** 19 students enrolled and completed this course. Upon completion, 74% of the class planned to apply for a PGY1 residency versus 63% prior to taking the course. 8 of the 19 students enrolled in the course attended the ASHP Midyear meeting in 2011. Previous to this class, no P2 or P3 students from this institution had ever attended Midyear.

**Conclusion:** Based on student feedback using surveys and reflective statements, this class will be offered in the fall of 2012 with a few minor changes. More time will be devoted to mock

interviews and feedback will be provided. Initial and final versions of the CV will be due several weeks apart to allow students time to make changes after receiving comments. Additional guest lecturers will be included this fall: a residency director, current resident discussing their residency project, and a medical science liaison and the entrepreneur lecture will be eliminated. With the increasing responsibilities of pharmacists, an elective on clinical pharmacy and residency training can be a beneficial option for second or third year pharmacy students.

**Category:** Preceptor Skills

**Title:** Impact of a required indigent care APPE rotation on perceptions of the underserved in a cohort of student pharmacists

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**Purpose:** To determine the impact of a required indigent care advanced pharmacy practice experiential (APPE) rotation on perceptions of the underserved in a student cohort pre- and post-experiential training. A survey was administered surrounding a curricular requirement to complete a rotation in indigent care.

**Methods:** A survey study was conducted at Samford University, McWhorter School of Pharmacy to assess students attitudes and perceptions toward the underserved before and after experiential training. The study received Institutional Review Board approval by the academic institution. Indigent care was defined as medically underserved, uninsured, or medically indigent patients for the purposes of this survey. Rotation practice sites spanned urban, suburban, and rural communities. A Likert scale questionnaire was offered via electronic mail by SurveyMonkey.com to the same class twice during the Doctor of Pharmacy program. The survey administration time coincided with a curricular requirement to complete a rotation in indigent care. Students were assessed at the end of their last didactic courses (end of the third professional year) and after completion of advanced experientials (end of the fourth professional year). Survey responses were analyzed with a Whitney U Test of the medians and independent samples of the median.

**Results:** Sixty students responded to the pre-experiential survey and 58 students responded to the post-experiential survey. More students felt better prepared in treating the underserved community after completion of experientials compared to preparedness following didactic curriculum ( $p=0.012$ ). There was no change in cohorts desire to volunteer in underserved communities after graduation, attitude that health care providers have an obligation to serve indigent patients, or perception that patients should receive health care regardless of ability to pay. There was a non-significant decrease in the number of students who felt that circumstances beyond the patients control led to inadequate access to healthcare. Free text student responses stated that they found the experiences rewarding; however other comments noted the lack of preparedness from the didactic curriculum in treating the underserved community besides making cost effective [therapy] decisions.

**Conclusion:** A required advanced experiential rotation in an indigent community improves student preparedness to treat indigent patients beyond the level obtained in didactic training alone. Further research may determine if efforts to introduce indigent care during introductory pharmacy practice experiences could further enhance student ability to treat indigent patients on APPEs.

5-175

**Category:** Preceptor Skills

**Title:** Pilot for an innovative teaching certificate program at a new college of pharmacy

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**Purpose:** With the establishment of new pharmacy schools, the demand for pharmacy educators is rapidly increasing. Pharmacy schools have a strong incentive to train residents to become effective educators. Numerous colleges of pharmacy offer teaching certificate programs to pharmacy practice residents with the goal of developing instructional skills, yet many programs vary in structure and format. The pilot teaching certificate program at Touro College of Pharmacy is available as an elective to post-graduate-year (PGY) 1 and PGY 2 residents in New York City and structured as a four-week intensive rotation that offers various instructional activities with additional longitudinal responsibilities.

**Methods:** As full-time pharmacy educators in training, residents participated in various teaching activities including laboratory facilitation, lecture preparation and delivery, preparation of assessment, interviewing prospective pharmacy student candidates, and various month-long projects. Longitudinally, the pilot offered 6 two-hour seminar sessions on the preparation and delivery of various instructional methodologies. The four-week intensive rotation exposed pharmacy residents to the daily culture of academic life and organization and structure of pharmacy program at the college. Three full-time faculty members coordinated the program, and mentored and evaluated residents performance. Pre and Post-evaluations measuring the residents level of confidence in various areas of teaching were collected and compared.

**Results:** During the 2011-2012 academic year, 3 PGY 1 residents enrolled in the teaching certificate program. Confidence was gained in their ability to design instructional materials, prepare and deliver a lecture, and assess student learning by creating examination questions and evaluation rubrics. The four-week pilot program provided residents with an improved understanding of the broad and diverse responsibilities of a career in academic pharmacy.

**Conclusion:** Our four-week intensive pilot teaching certificate program benefits residents with the development of skills necessary to become effective educators and through its intensive structure mimics the practice of a full-time faculty member, thereby providing a unique experience in academic pharmacy.

**Category:** Psychotherapy / Neurology

**Title:** ANCHOR-CD (AboobotulinumtoxinA Neurotoxin: Clinical and Health Economics Outcomes Registry in Cervical Dystonia): A Multicenter, Observational Study of Dysport in Cervical Dystonia: Baseline Data and Cycle One Outcomes Data

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**Purpose:** ANCHOR-CD is a prospective, open-label, observational study of adult patients with idiopathic cervical dystonia (CD) designed to evaluate real life patient response and health economics data from patients treated with abobotulinumtoxinA (known as Dysport). Interim efficacy (cycle one) and patient satisfaction outcomes data are reported.

**Methods:** Prospective, open-label, observational study of adult patients with idiopathic CD. Efficacy assessments include: the Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS), Pain Numeric Rating Scale (NRS), Clinical Global Impression of Change (CGIP), Patient Global Impression of Change (PGIC), and Treatment Satisfaction Questionnaire for Medication (TSQM).

**Results:** Baseline patient demographic, history, and health economic data were collected from 155 patients enrolled at 40 US clinical sites. Treated population comprised of 76% females and 24% males, mean age 58.2 years. Types of dystonic neck posturing included torticollis (81.3%), laterocollis (50.3%), retrocollis (25.8%), and anterocollis (16.1%). The median abobotulinumtoxinA dose was 500 Units. The most frequently injected muscles were the splenius capitis, levator scapulae, trapezius, semispinalis capitis, and sternocleidomastoid. Preliminary analysis included 122 patients who completed follow-up assessments for treatment cycle one. Mean (SD) TWSTRS total score was 40.3 (16.7) at baseline and 27.3 (15.5) at 4 week follow-up demonstrating -13.1 (9.2) mean change or 33% improvement compared to baseline. Mean (SD) Pain NRS score was 4.9 (3.0) at baseline and 3.6 (2.7) at 4-week follow-up demonstrating -1.4 (2.6) mean change compared to baseline. 63.9% of physicians 40.2% of patients rated much improved and very much improved for the CGIC and PGIC, respectively.

**Conclusion:** Physicians and cervical dystonia patients treated with abotulinumtoxinA reported improvements in the severity, disability and pain of CD.

**Category:** Psychotherapy / Neurology

**Title:** ANCHOR-CD (AbobotulinumtoxinA Neurotoxin: Clinical and Health Economics Outcomes Registry in Cervical Dystonia): A Multicenter, Observational Study of Dysport in Cervical Dystonia: Patient Demographic, History, and Health Economics Data

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**Purpose:** To report baseline patient demographic, history and health economics data of cervical dystonia patients treated with abobotulinumtoxinA (known as Dysport) who are enrolled in a prospective, open-label, observational study (ANCHOR-CD) designed to evaluate real life patient response and health economics data.

**Methods:** Prospective, open-label, multicenter observational study. Collection of health economics outcomes (HEO) data included patient demographics, history, prior therapy, abobotulinumtoxinA dose, patient perceived obstacles to therapy.

**Results:** Baseline patient demographic, history, and health economic data were collected from 155 patients enrolled at 40 US clinical sites. The patients are 76% female; mean age is 58.2 years; mean 6.5 years from reported time of diagnosis; mean 39.2 months reported delay from symptom onset to diagnosis; 14.2% with positive family history of cervical dystonia. The primary type of cervical dystonia as evaluated by the enrolling investigators was: rotational torticollis (81.3%), laterocollis (50.3%), retrocollis (25.8%), and anterocollis (15.5%). Of these, 75.5% had previously received other botulinum toxin therapy for CD at median doses of 280 Units for onabotulinumtoxinA (Botox), and 8500 Units for rimabotulinumtoxinB (Myobloc). AbobotulinumtoxinA 500 Units was the median dose injected at registry-entry. 50.3% of patients reported obstacles or delays that potentially hampered obtaining botulinum toxin therapy for CD including: travel distance to clinic (39.4%), treatment cost (29%) and time away from work/scheduling (29%).

**Conclusion:** Baseline patient demographic, history, and health economic data provide insight into current real-world utilization of abobotulinumtoxinA. This information may help address obstacles to receiving treatment for cervical dystonia.

**Category:** Psychotherapy / Neurology

**Title:** Role of buprenorphine and naloxone in VA Medical Center opioid treatment programs

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**Purpose:** Opioid treatment programs have existed for many years dispensing monitored doses of liquid methadone to patients. Due to increasing numbers of patients requesting opioid dependency treatment and limited access to opioid treatment programs, buprenorphine/naloxone was FDA approved in 2003 to increase availability of opioid replacement therapy via an office based setting. Over the past few years at the Portland VA Medical Center, providers have requested certain patients receive monitored buprenorphine/naloxone dosing through the in-house opioid treatment program. Although many studies have compared the efficacy of methadone to buprenorphine/naloxone with inconclusive findings, no study has previously evaluated clinical effectiveness of buprenorphine/naloxone dispensed through an opioid treatment program in comparison to buprenorphine/naloxone office-based treatment.

**Methods:** This retrospective chart review included three treatment arms methadone opioid treatment program patients (control group), buprenorphine/naloxone opioid treatment program patients, and buprenorphine/naloxone office-based treatment patients. Patients were included into the initial data pool if they were a new start opioid replacement therapy patient within the past three years. Exclusion criteria included treatment lasting less than a month and those without available drug screens during time frame evaluated. For those meeting this criteria, patient data was collected for up to six months beginning the second month of therapy. The primary outcome of this study was the percentage of urine drug screens positive for opiates in each treatment group. The secondary outcome was the percentage of urine drug screens positive for any substance in each of the three treatment groups. Information was also collected to evaluate for patterns in opioid dependant patient demographics including age, gender, Qtc (baseline and during treatment), comorbid psych conditions, ED visits and hospital admissions, as well as prescribing trends of buprenorphine/naloxone and methadone at this medical center.

**Results:** Numbers of patients for each treatment group included methadone opioid treatment program (n=34), buprenorphine/naloxone opioid treatment program (n=17), and buprenorphine/naloxone office based treatment (n=23). This pilot study found statically significant differences for the primary outcome of percent positive opioid drug screens between the methadone group and both buprenorphine/naloxone groups [methadone group 16.8%, buprenorphine/naloxone opioid treatment program 12.2%, ( $p < 0.001$ ), and the buprenorphine/naloxone office based group 8%, ( $p = 0.0318$ )] but found no difference for this outcome between the two buprenorphine/naloxone groups ( $P = 0.738$ ). For the secondary

outcome, positive drug screens for any substance, there was no difference in outcomes identified between treatment groups (methadone group 18%, buprenorphine/naloxone opioid treatment program 16%, and buprenorphine/naloxone office based group 17%). A statistically significant variation in patient age was noted between treatment groups. Patients in the buprenorphine/naloxone office based group were found to be younger than the other study groups [(p<0.001), office based buprenorphine/naloxone mean age 35.4 years, opioid treatment program buprenorphine/naloxone mean age 48.8 years, and the methadone mean age 53.4 years)]. Qtc at baseline was not different while on treatment for patients taking buprenorphine/naloxone, but was significantly greater in patients taking methadone [(p=0.025), average methadone patient Qtc at baseline 434.2, and 443 on treatment]. There was noted also variation in substance abuse history, comorbid psychiatric conditions, ED visits and hospital admissions between groups.

**Conclusion:** Consideration may be made to discontinue opioid treatment program dosing of buprenorphine/naloxone at this medical center as outcomes were not shown to differ in comparison to buprenorphine/naloxone office based treatment. Larger studies are needed to more fully evaluate the outcomes of this study, and at this time, selection of the drug, dose, and duration should continue to be a multifactorial, patient specific decision when treating chemical dependency.

**Category:** Psychotherapy / Neurology

**Title:** Assessment of concomitant antipsychotic therapy at an inpatient psychiatric service

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**Purpose:** Concomitant antipsychotic therapy has become common practice in many psychiatric settings despite limited evidence to support this practice. The Joint Commission core performance measures for hospital based inpatient psychiatric services include patients discharged on multiple antipsychotic medications and patients discharged on multiple antipsychotic medications with appropriate justification. Despite this, patients are often prescribed concomitant antipsychotic therapy with little information regarding current or historical justification. We sought to gain a better understanding of prescribers' knowledge regarding current or historical justification for patients receiving concomitant antipsychotic therapy.

**Methods:** Prescribers were surveyed regarding the rationale for the current concurrent scheduled antipsychotic regimen. In addition, the prescribers knowledge of single agent trials and augmentation strategies prior to the initiation of concurrent antipsychotic therapy was queried.

**Results:** Thirty eight patients were prescribed scheduled concomitant antipsychotic therapy at the time of the survey, representing twenty four percent of the inpatient population. Eighteen patients were prescribed a regimen containing one first and one second generation antipsychotic, thirteen patients were prescribed a regimen containing two second generation antipsychotics and one patient was prescribed a regimen containing two first generation antipsychotics. Six patients were prescribed a regimen containing three antipsychotics. The most commonly prescribed regimen was clozapine and risperidone. Treatment of refractory positive symptomatology was the most common reason given for concomitant therapy. In no case was the prescriber unaware why the patient was receiving concomitant antipsychotic therapy. Prescribers did not have a great deal of knowledge regarding prior single agent trials or augmentation with other psychotropic agents prior to initiating concomitant antipsychotic therapy. Few prescribers had plans to simplify the current regimen.

**Conclusion:** A better understanding of current and historical medication trials would allow prescribers to make more informed decisions regarding the use of concomitant antipsychotic therapy. This is often difficult to achieve due to the extraordinary amount of time required to review the medication histories of chronically mentally ill persons. To improve this situation, prescribers should regularly document the justification and response of a patient to concomitant

antipsychotic therapy. This, combined with historic medication trial information could markedly improve the capacity to maximize therapeutic efficacy and minimize side effect burden when employing judicious concomitant antipsychotic therapy as well as provide justification for such interventions at discharge.

**5-180**

**Category:** Psychotherapy / Neurology

**Title:** Evaluation of the pharmacotherapy of Parkinsons disease in a tertiary care Lebanese hospital

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**Purpose:** The treatment of Parkinsons disease (PD) is tailored to each patients stage, age, and tolerability of adverse effects. The objective of this study is to evaluate the appropriate use of PD medications in a tertiary care hospital in Lebanon as well as the treatment of comorbidities of PD and prophylaxis and treatment of adverse effects.

**Methods:** The institutional review board approved this study, conducted in a Lebanese tertiary care. Data collection was done using a single center retrospective and longitudinal design. 200 patients, men and women, from more than 10 different countries having at least 40 years of age were included in the study. The primary outcome measure of the study was to evaluate appropriateness of pharmacological treatment of PD at the center, according to age and stage, using the most relevant recommendations in the NICE and SIGN guidelines. The secondary outcome measures were to evaluate the frequency of occurrence of adverse effects and drugs used to avoid them, the occurrence of autonomic and psychiatric dysfunction, as well as their corresponding therapy.

**Results:** 50 patients included in the study were taking a dopamine agonist out of whom 28% (14 patients) have mild disease and having more than 60 years of age. Patients having mild disease and having less than 60 years of age and taking medications containing Levodopa are 89% (16 out of 18 patients) even though they can tolerate at this stage dopamine agonists. Patients having mild disease and who can tolerate dopamine agonists should use levodopa at a later stage.

**Conclusion:** This study provides information regarding treatment prescribed in Lebanon taking into consideration the availability of the medications on the market, the variability of response between patients and the difference in tolerability in each one of them. Adherence and compliance to the treatment is necessary in PD because skipping one dose will have a direct effect on the quality of life of the patient and daily activities. A better understanding of this phenomenon and the interventions needed to address would contribute to the increased effectiveness of therapeutic measures, a reduction in morbidity and mortality and a better quality of life.

5-181

**Category:** Quality Assurance / Medication Safety

**Title:** Impact of a pharmacist-led adverse drug reaction (ADR) surveillance program in a pediatric medical center

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**Purpose:** Due to reliance on voluntary reporting mechanisms, adverse drug reactions (ADRs) were poorly detected at our facility, occurring in only 0.5% of patients. Additionally, historical ADRs were often inaccurately or incompletely documented. A pharmacist-led ADR surveillance program, the Drug Safety Service (DSS), was implemented to help address these issues. The primary objective of this program was to improve detection of new ADRs. Secondarily the DSS aimed to more accurately document historical ADRs.

**Methods:** For all patients admitted with a new or historical ADR, the DSS completed an electronic standardized ADR questionnaire with the patient (or family) that characterized the mechanism (allergy, side effect, etc.), severity (mild, moderate, severe), and description of each reaction. Any information on cross reactive medications was also collected. To facilitate detection of unreported ADRs, a number of computerized ADR trigger reports were also created. All interventions were recorded in a database to monitor the programs efficacy toward achieving the objectives.

**Results:** For the primary outcome, ADR detection improved from 20 (baseline) to 119 (4th quarter 2011) ADRs per quarter. During the first year of DSS operation, 1,197 active and historical ADRs were evaluated in 672 patients. In 485/1197 (41%) of the reactions, the patient could tolerate the reported medication or one in a cross-reactive class. Of the 936 reactions initially categorized as an allergies, 25% were appropriately re-categorized as side effects. The ADRs could be removed from the patients profile in 60/1197 (5%) reactions. Incorrectly reported reactions with the potential to cause patient harm (e.g. wrong drug, etc.) accounted for 45/1197 (4%) reactions.

**Conclusion:** A comprehensive pharmacist-led ADR surveillance program was able to improve detectability of ADRs, as well as the accuracy of their documentation. Through creation of computerized ADR trigger tools and having dedicated personnel to investigate ADRs (DSS), ADR detection increased by approximately 450%. By completing a standardized ADR questionnaire, the DSS determined that approximately 40% of patients could receive the reported medication or one in a cross-reactive class, demonstrating that drug allergies are not necessarily contraindications to medications.

5-182

**Category:** Quality Assurance / Medication Safety

**Title:** Pharmacy and nursing collaboration to improve medication availability

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**Purpose:** Through pharmacy and nursing collaboration, non automated dispensing cabinet (ADC) missing doses were identified as a major source of stress. Nurses were spending a significant amount of time away from the bedside searching for medications and contacting pharmacy. This resulted in increased workload and drug waste. This project was designed to identify reasons why missing doses occur and to develop corrective strategies. The ultimate goal was to increase nursing time spent at the bedside as well as improve patient satisfaction and Hospital Consumer Assessment of Healthcare Providers and Systems (HCAPS) scores.

**Methods:** Missing doses were reviewed over a four week time period in the critical care pharmacy and five intensive care units (ICU) at a large tertiary care hospital. Daily medications not available in the ADC were delivered to the ICU via medication cart which was exchanged daily between 11am and 12pm. Medications were supplied for 24hrs (12pm to 11:59am). Nurses communicated missing doses to pharmacy using a "missing dose form" or by calling the pharmacy. Missing dose forms were collected for the first week to get a baseline. During the next three weeks, the medication cart was checked daily using, as before, using a cart fill list that printed at 6:30am. A second updated list was added that printed at 10:45am which was used to update the cart just before the cart exchange. Another pharmacist audited the cart medications in the ICU with the nursing manager using the medication administration record (MAR) plus the cart fill and updated list. Discrepancies were documented. This process was repeated daily on weekdays in the five ICUs. Missing dose forms were collected to document the frequency and nature of missing doses. If a nurse called regarding a missing dose, she was instructed to send a missing dose form for documentation.

**Results:** The baseline number of missing dose forms sent per day was 19 (range 10 to 32). The average number of missing dose forms received decreased to 15 per day (range 6 to 18) in week four. Major reasons identified for missing doses included: the nurse did not know where to look for medication or could not find the medication (33%), order entry error (4%), and problem with the original order requiring clarification (4%). Nurses were also using the missing dose form inappropriately for first doses (35%) and IV requests (4%) and scanned missing dose requests twice (4%) resulting in extra work for both pharmacy and nursing. The medication cart had an average of one error per ICU per day (range 0 to 6). Major reasons identified for cart fill errors

included: medication not sent or sent late (31%), order entry error (25%), and dose administered at wrong time (20%).

**Conclusion:** Reasons for missing doses were multi-factorial and involved both pharmacy and nursing. For over two thirds of the missing dose forms received in pharmacy, the dose was not actually missing. Education was provided to pharmacy and nursing staff and leadership as to reasons why daily medication doses might be missing, appropriate use of the missing dose form, and how to prevent missing doses.

**Category:** Quality Assurance / Medication Safety

**Title:** Impact of drug shortages on Israeli hospitals

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**Purpose:** Shortages of drugs can negatively affect drug therapy, delay medical procedures and increase medication errors. Managing drug product shortages is particularly complex for practitioners in hospitals, because those facilities routinely treat patients with acute conditions, use significant number of drugs, single source products and use high cost new drug technologies. Pharmacists are challenged during drug product shortages to ensure the provision of safe and therapeutically equivalents preferably at comparative costs. A survey of pharmacy activities was performed in order to quantify personnel and information resources required to manage drug shortages in governmental hospitals in Israel.

**Methods:** An online questioner was send to all 14 directors of pharmacy services in general hospitals. Pharmacists were asked to identify the 40 most recent drug shortages and actions taken to manage this issue. All hospital purchases most of their drugs from the same governmental wholesaler, so they were equally affected. Six categories of actions were defined: monitoring and moving stock to avoid shortage, prioritizing remaining supplies, changing dispensing practice, dispensing same drug in different strengths, substitution of a different therapeutic agent and notification of health staff (nurses and physicians). Average time needed to solve each drug shortage and labor costs were calculated. Four sources of information on drug shortages were evaluated as well: FDA site, Israel Wholesaler website, direct communication with manufacturer and Israeli Ministry of health - pharmacy department website -the Israeli (FDA).

**Results:** A total of 71% (10 directors of hospital pharmacies) completed the survey. There was a significant association (one way ANOVA ' analysis,  $p=0.0001$ ) between time required to manage drug shortages and hospital size. Average time required (hours) to handle all drug shortages in hospitals' size 500 beds was 80.9 with a std. deviation of 2.0, size of 600-800 beds and those more than 800 beds were 148.8 with std. deviation of 14.0 and 220.0 with std deviation of 4.1 respectively. Estimated annual labor cost required to manage drug shortages was equivalent to 6 full time employees for all hospitals involved in this survey. Respondents indicated using most frequently monitoring and moving stocks (90%), prioritizing remaining supplies (87%) and notifying health team members (75%). Substitution of a different therapeutic agent was used less often (24%). Respondents rated the usefulness of the four sources on drug shortage based on a mean score (using a 5 point Likert scale), assessing three variables: timelessness of information, anticipated duration of the shortage and suggestions for alternatives. FDA and Israel Wholesaler websites scored 3.5 points; manufacturers and the Israeli (FDA) scored 2.9 and 1.6 points respectively.

**Conclusion:** This survey revealed that time to manage drug shortages is significant and information needed in order to handle those shortages is insufficient.

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**Category:** Quality Assurance / Medication Safety

**Title:** The Effect of Day Two Vaccination on Pneumococcal Vaccine Administration Core Measure Compliance

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**Purpose:** Pneumococcal vaccination on day of discharge has not been effective in assuring adequate compliance with vaccine administration. A survey of top performing hospitals indicated that vaccination prior to day of discharge is more effective. Vaccination on day two of admission was piloted on two inpatient units (J4 and H1). Our purpose was to improve compliance with administration. Pneumococcal vaccination is also a required element in providing appropriate care for pneumonia patients. If the pilot achieves success, day two vaccination will be rolled out housewide and a second population of pneumonia patients will be evaluated for improved compliance. Invasive Pneumococcal infections cause an estimated 5,000 deaths annually in the United States. Pneumococcal infections result in approximately 2.4 million days of hospitalization. The highest mortality occurs among the elderly and those with underlying medical conditions. A large proportion of these cases and deaths are preventable through vaccination. Vaccination of hospital inpatients will capture a large portion of this population and is considered best practice. Assuring compliance with vaccination by implementing an improved process will help save lives. This will also be beneficial to our hospital, as this is publically reported data.

**Methods:** Random sampling of patients discharged from the pilot units was performed, following a predetermined process, to reach our sample size. Retrospective chart reviews evaluated compliance with vaccine administration. The housewide patient population was obtained from our UHC vendor and included a random sample of patients diagnosed with pneumonia.

**Results:** Education was provided to the nurses on the pilot units. Implementation began with an assessment of all current inpatients, to assure no patient was missed during the conversion from day of discharge to day two. Pre and post data showed successful roll out of the changed process on the pilot units ( $p=0.012$ ). A plan was developed to implement the process house wide. Education ensued with communication to all appropriate units. Data was evaluated from the quarters preceeding and following the housewide roll out, which demonstrated continued success with the changed process ( $p=0.009$ ).

**Conclusion:** Issues were identified and communication followed to assure complete and accurate assessment of inclusion/exclusion criteria; pharmacy communication and evaluation

prior to discharge. We are hopeful this new process will also benefit our influenza vaccination compliance with the next flu season.

**Category:** Quality Assurance / Medication Safety

**Title:** Effect of Computerized Provider Order Management on Reported Medication Variances Relating to Anticoagulation

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**Purpose:** To determine if various types of anticoagulation medication variances has changed since implementation of a CPOM (Computerized Provider Order Management) system based on voluntary variance reporting?

**Methods:** All reported medication variances involving anticoagulation (warfarin, enoxaparin, heparin, rivaroxaban, argatroban, dabigatran, fondaparinux, bivalirudin, and dalteparin) were analyzed from two 3 month time periods, July - September 2011 (pre-CPOM) and November 2011 - January 2012 (post-CPOM). Data was collected using MIDAS (electronic variance database). Variances were categorized using the National Coordinating Council for Medication Error Reporting and Prevention NCC MERP Medication Error Category Index with 'A' variances representing events that have the capacity to cause error to 'I' variances representing an error that contributed to or resulted in a patient death. Category 'A' variances were not included in the analysis.

**Results:** Anticoagulation variances increased from 6.8% to 9% of total medication variances reported following implementation of CPOM. Anticoagulants increased from the 3rd most reported medication class involved in variances to the 2nd. There was also an increase in number of reported variances reaching the patient (category 'C' or higher). Prior to CPOM implementation, 19.6% of reported anticoagulation medication variances involved handwriting and scanning issues to pharmacy, while another 5% of these reported variances included entry errors on the wrong patient during pharmacy transcription. Both of which we anticipated resolving following implementation of CPOM, and was verified during this review with both areas of reported variances decreasing to a combined rate of only 1.8%. In the first several weeks post-CPOM, there were multiple computer system issues that were identified and quickly resolved by our Information Technology team. Numerous reported variances were unaffected by CPOM, including administration variances involving rates and routes. Based on variance reports post-CPOM, it was identified that appropriate ordersets were not always being utilized, leading to policy variances and lack of appropriate lab ordering. However, the orderset use was still increased from pre-CPOM, which may help explain a decrease of policy variance reports from 17.8% to 8.9%. Inappropriate orders for warfarin exceeding a day in duration that reached the MAR post-CPOM increased to 5% of reported anticoagulation variances compared to 0 reports

when pharmacists were entering orders. New issues regarding the different workflows for communicating anticoagulation matters became a focus for education. CPOM also significantly increased anticoagulation consults for pharmacy from an average consult rate of 46% pre-CPOM to 82% post-CPOM. The addition of an inpatient anticoagulation pharmacist was required to manage the increased workload.

**Conclusion:** Multiple types of variances were unaffected by CPOM and still required the health care team to continue current safe medication practices (i.e. RN dual signature, barcoding, and smartpump technology), and evaluation of duplicate therapies and drug interactions. However, many types of variances were impacted by CPOM which has led to alterations of workflows and created a new pharmacy position. Reported anticoagulation variances will continue to be investigated to identify trends and potential opportunities for improvement.

**Category:** Quality Assurance / Medication Safety

**Title:** Reducing missed doses events in admitted patients using pre-admission medication reconciliation

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**Purpose:** Patients coming into a 135 bed acute care hospital for elective procedures were missing doses of routine maintenance medications due to lack of formulary availability. The medications required purchase from our wholesaler, borrowed from another facility several miles away, or brought in by a family member. Each of these options causes delay in dosing the medication and missed doses ranging from 1 to 3 days. These delays caused patients to be dissatisfied with our services. Using elective procedures through a pre-admission process, the goal was to eliminate missed doses of maintenance medications and improve patient satisfaction.

**Methods:** Beginning October 1, 2011, a pharmacist obtained a list of all scheduled surgical procedures for the upcoming week. To maintain a manageable starting point for this project, we focused on elective orthopedic procedures. Between the patients pre-admission visit at the hospital and the scheduled day of the procedure, a pharmacist called each patient at home to review a medication history. Patients were asked to verify their home medications including the medication name, the dose and the frequency at which they took the medications. Patients were also asked specifically about home use of pain medications. When non-formulary medications were identified, the pharmacist explained the formulary process and the reasons for the formulary as well as the therapeutic substitution program. Patients were able to ask questions to better understand why some medications were not available at the hospital. The pharmacist discussed options with the patient to make sure their maintenance medications stayed on schedule. We requested the patient to provide their own medication during the stay following the hospital's policies and procedures. When the patient seemed confused or was not comfortable with that plan, the pharmacist made arrangements to obtain a small supply of the non-formulary medications from an alternate source to prevent missed doses. The resource requirement for this pilot project involved one pharmacist for approximately 2 hours per week on average to make phone calls. Time was allocated daily throughout the week to complete all phone calls and documentation. While data is not available, staff strongly feels that the time used for calls more than offset the time required to follow up to obtain the medications after the procedure at the time of admission.

**Results:** Between November 14, 2011 and January 28, 2012, 90 surgical patients were contacted by a pharmacist. Interventions related to pre-admission reconciliation consisted of clarification of the medication name (5%), clarification of the frequency (8%), clarification of the dose taken (13%) and for non-formulary medications (66%). Of those non-formulary maintenance medications, therapy was safely held 32% of the time based on the pharmacists recommendations to the surgeon (sometimes after consulting with the primary care provider). Patients provided their own medication 19% of the time and the medication was converted to a formulary alternative in 49% of cases. Overall, 91% of the pharmacists recommendations were followed by the surgical providers. One provider caused the 9% non-compliance. One on one discussion with that provider made him more aware of the program and he changed his behavior. During the study period, only 3 doses of non-formulary maintenance medications were missed. One patient forgot to bring in the medication. Prior to implementation of this program, an average of 6 doses of non-formulary medications were missed each week.

**Conclusion:** Based on the results of our study period, it was determined that the time spent contacting patients to perform pre-admission medication reconciliation by a pharmacist is time well spent. Patients voiced their satisfaction with the process because it could be completed in surroundings comfortable to them and with ready access to their medications. Since the trial, additional pre-admitted patient types have been added to our program with similar success. Pharmacists believe the time taken on the front end of this process saves more time on the back end trying to contact providers to determine what to do with non-formulary medication orders.

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**Category:** Quality Assurance / Medication Safety

**Title:** Creation of a standardized USP 797 training process and lab practicum examination for certified pharmacy technicians

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**Purpose:** An analysis of reported medication safety events and assessment of IV room processes revealed opportunities for improvement. The lack of a common practice for preparing and labeling intravenous (IV) products by certified pharmacy technicians (CPhT) was identified as a potential medication safety issue. This project was designed to identify and correct inconsistencies in the knowledge and process for preparing IV products according to USP 797 guidelines by CPhT.

**Methods:** After review of the USP 797 guidelines, a pharmacy technician supervisor and a pharmacist created a standardized process to educate all CPhT in the preparation of IV products. A curriculum was designed which included the creation of an IV room training manual, workshops which demonstrated key points of importance and a lab practicum examination to validate competency. A process for remediation was also developed for CPhT who failed to demonstrate competency. All CPhT were required to complete and pass the examination in order to staff in the IV room.

**Results:** A total of 37 CPhT completed the standardized curriculum. 73% of CPhT passed the lab practicum examination on their first attempt. The remaining 27% CPhT completed remediation, of which 97% were successful in passing the lab practicum examination post remediation. A reduction in the number of reported medication safety events was found after completion of the training. The curriculum will be administered to all new hires.

**Conclusion:** A standardized curriculum and lab practicum examination was successfully created to educate and assess knowledge and compliance with USP 797 standards among CPhT.

**Category:** Quality Assurance / Medication Safety

**Title:** A Multidisciplinary Approach to Improving Medication Safety

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**Purpose:** Describe a multidisciplinary approach to evaluate, analyze and trend medication incidents. We will highlight enhancements to the computerized provider order entry system (CPOE) and electronic medication administration record (EMAR). In addition we made advancements to our pharmacy computer system, IV smart pump/drug dictionary and pharmacy automated medication dispensing system. Implementation of all of these programs has decreased the number of medication incidences which has led to increased patient safety.

**Methods:** We have a medication safety committee that consists of representatives from pharmacy, medical staff, nursing informatics, nursing, information services and healthcare quality. This Committee meets on a monthly basis to analyze and trend medication incident data that is reported through our online safety reporting system. The Committee also reviews medication safety reports on a per case basis. The Committee suggests corrective action to prevent future medication incidents and improvements to electronic medication systems.

**Results:** From February 2009 to December 2011 transcription incidents decreased in all medurg units throughout the hospital. Enhancements were made to the drug scripts in our CPOE system. We attached patient monitoring parameters to all cardiac and opiate drug scripts, and lab results to specific drugs. We modified severity levels of drug drug interactions and our drug interaction program. We created drug rules to alert healthcare providers when important issues arise. We enhanced our allergy reporting system to better communicate to the healthcare team. We also created tools to provide education to prescribers and utilize those tools as a drug information source to other healthcare providers. In the drug dictionaries across our pharmacy system, IV pump and automated medication dispensing system, we added uniform tall man lettering to distinguish between sound-alike/look-alike medications. In the automated medication dispensing system we also put look-alike and high alert drugs in separate lidded pockets and in different drawers.

**Conclusion:** A multi-disciplinary approach to reviewing medication incidents can lead to improved patient care from many different points of view and can lead to system improvements over many key medication systems. We have highlighted several areas in which we have made improvements to demonstrate how one can enhance these systems to further promote patient safety. Often having electronic systems, one is led into a sense of false security. Even though these systems provide safe approaches to medication processes there is always room for further enhancements.

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**Category:** Quality Assurance / Medication Safety

**Title:** Detection and analysis of errors in prescriptions for discharged patients

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**Purpose:** The pharmacist represents the final point at which prescribing errors and related problems can be identified and corrected in order to improve quality of care and assure patient safety. Thus, identification and correction of prescribing errors represent major pharmacist's legal, professional and ethical responsibilities to the patient. The objective of our project was to examine the prevalence of prescribing errors, characterize the common errors and develop an intervention protocol in order to minimize the number of prescription errors.

**Methods:** A team of experienced pharmacists developed a form that contains all the possible errors that could be found in a prescription and are categorized as minor, serious, life threatening or administrative errors. Each prescription that is presented to the pharmacy is comprehensively analyzed and checked for errors and appropriateness. When an error is identified, the form is used to inform the doctor about the error, to document and analyze. The data is collected by an appointed pharmacist and categorized according to the type and the severity of errors.

**Results:** In the period of 17 months between August 2010 to January 2012, 46,341 prescriptions for discharging patients were received and reviewed at the hospital pharmacy. There were identified 216 erroneous prescriptions that needed a pharmacist intervention. The total number of errors in these prescriptions is 487, in which 94 errors (19.3%) are life threatening. The analysis has showed that the most common errors are: 1. The name of drug is not written in capital letters: 136 errors (27.9%). 2. Daily dose missing: 104 errors (21.3%). 3. Wrong dose: 72 errors (14.8%). 4. The writing is illegible: 36 errors (7.4%).

**Conclusion:** The developed form has made the pharmacist doctor communication more efficient. The doctor can see immediately the error in the issued prescription and to correct it. The errors analysis help to identify the problematic areas and helps to define an intervention working model that will prevent these errors on the future in order to ensure the patient safety.

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**Category:** Quality Assurance / Medication Safety

**Title:** Admission medication reconciliation utilizing a pharmacy technician and pharmacist team in the emergency department: a pilot study

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**Purpose:** Medication errors are frequent during transitions of care upon hospitalization. Studies show medication errors and patient harm can result from inaccurate or incomplete medication histories. An internal analysis of reported medication errors and pharmacist intervention documentation showed that there is significant opportunity for improvement with our current nursing-conducted admission medication reconciliation (AMR) process. The objective of this pilot was to evaluate the accuracy of medication history in the electronic medical record at the time of hospital admission utilizing a pharmacy team (pilot group) versus nursing (control group).

**Methods:** A multidisciplinary quality improvement team developed a pharmacy technician and pharmacist team-based pilot program. Prior to the initiation of the pilot, the pharmacy technicians received formal training and mentoring on patient interviewing skills, medication safety, top 200 prescription drugs, and the ED electronic medical record system. On Monday through Friday, from 12:30pm to 9:00pm, a pharmacy technician interviewed patients in the ED, and clarified patients home medication list in the electronic medical record. A pharmacist received both the technicians and the nurses AMR forms and performed additional clarifications with patient, family members, doctors offices, or outside pharmacies when appropriate. A hospital physician then used the final AMR form for admission orders. Data collection was done in two steps. In step one, we looked at number of medication errors and medication discrepancies identified by the AMR pharmacy team in the pilot group. In step two, after AMR pharmacy team completed their interventions, the pilot AMR forms were then retrospectively compared to the AMR forms in the control group. For the purpose of this study, medication errors were defined as incomplete medication orders, incorrect medication orders, omissions, discontinued therapy, and duplications. The study also looked at medication discrepancies which included medication errors and missing date/time when last dose was taken.

**Results:** In step one, there were 1750 discrepancies identified in 185 pilot patients, with an average of 9.5 +/- 7.3 discrepancies per patient. More than half of the discrepancies were missing date/time when last dose was taken (963/1750), leaving a total of 787 medication errors, an average of 4.2 +/- 3.4 medication errors per patient. The most common medication errors identified by the AMR pharmacy team were incomplete medication orders (40.7%, 320/787),

incorrect medication orders (27.5%, 217/787), and omissions (24.5%, 193/787). In step two, there were 48 discrepancies missed by the AMR pharmacy team, compared to 1547 discrepancies missed by nursing, an average of 0.3 +/- 1.0 discrepancies per patient in the pilot group versus 8.7 +/- 7.8 discrepancies per patient in the control group ( $p < 0.001$ ). In addition, there were 25 medication errors, an average of 0.2 +/- 0.5 per patient in the pilot group, compared to 425 medication errors, an average of 2.4 +/- 2.5 per patient in the control group ( $p < 0.001$ ). In the control group, the most common medication error identified was incomplete medication orders (79.5%, 338/425).

**Conclusion:** A pharmacy technician-pharmacist team significantly improved the accuracy of the patient medication history, and uncovered a significant number of medication errors not apparent from the electronic medication list. The majority of the medication errors were incorrect medication orders and omissions. A pharmacy technician and pharmacist team can facilitate the admission medication reconciliation process and promote patient safety.

**Category:** Quality Assurance / Medication Safety

**Title:** Quality assurance for parenteral nutrition using laboratory analysis of electrolytes

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**Purpose:** Preparing parenteral nutrition (PN) is a complex process involving the combination of many different components, and as such, carries the potential for causing serious harm or death to the patient if compounded incorrectly. Automated compounding devices improve the accuracy and reliability of PN compounding, but the potential for error still exists. Therefore, the American Society for Parenteral and Enteral Nutrition (ASPEN) and the American Society of Health System Pharmacists (ASHP) recommend ongoing quality assurance of the compounding process using gravimetric, refractometric, or chemical analysis. Gravimetric analysis is limited in that it can only measure the total contents, not the additives. Some additives in PN, such as dextrose and amino acids, are easily measured by refractometric analysis; however, electrolyte concentrations cannot be reliably measured using a refractometer and must be determined by chemical analysis. Electrolyte disturbances in PN can have devastating consequences, especially in pediatric patients. Therefore, the purpose of this study is to compare values determined from chemical analysis by the hospital laboratory for the electrolytes sodium, potassium, calcium, phosphorous, and magnesium against calculated values of the same electrolytes in PN as a quality assurance method.

**Methods:** All PN solutions were prepared by an automated compounding device. A set-up sample PN of standard concentrations of electrolytes was prepared with electrolyte concentrations of: sodium 76 mEq/L (+/- 15), potassium 25 mEq/L (+/- 12), calcium 38 mg/dL (+/- 15), magnesium 5 mg/dL (+/- 2), and phosphorous 24 mg/dL (+/- 15). Samples were also taken from individualized pediatric PN solutions and sent to the hospital laboratory for chemical analysis. The laboratory would then process the PN samples as urine samples. Electrolyte concentrations and laboratory results were double-keyed and verified by the investigators. The calculated and measured electrolyte concentrations were compared statistically by descriptive statistics, a linear regression analysis, Pearson correlation coefficient, and the r-squared value. Statistical significance was pre-determined to be <0.05 with a correlation of r-squared 0.90 considered highly correlated.

**Results:** Laboratory analysis of 235 standard concentration bag samples gave the following results: sodium average of 84.7 mEq/L (SD=4.05), potassium average of 19 mEq/L (SD=1.26), calcium average of 38 mg/dL (SD=4.73), magnesium average of 5.2 mg/dL (SD=0.9),

phosphorous average of 30 mg/dL (SD=3.23). Most of the samples (92%) fell into our predetermined range. Laboratory analysis of 606 individualized pediatric PN samples gave the following results. The measured sodium concentration ranged from 5 to 175 mEq/L ( $r^2=0.987$ ), measured potassium ranged from 2.5 to 93.8 mEq/L ( $r^2=0.943$ ), measured calcium concentration ranged from 1 to 125.1 mg/dL ( $r^2=0.979$ ), measured magnesium concentration ranged from 1.2 to 38 mg/dL ( $r^2=0.891$ ), measured phosphorous concentration ranged from 5.5 to 132 mg/dL ( $r^2=0.919$ ). All p-values were  $<0.001$ . There were limits in how low the laboratory could measure. Values could not be lower than 5 mEq/L for sodium, 2.5 mEq/L for potassium, 1 mg/dL for calcium, 1.2 mg/dL for magnesium, and 5.5 mg/dL for phosphorous. The correlation of values also decreased as electrolyte concentrations reached higher values. Laboratory analysis of 606 individualized pediatric PN samples gave the following results. The measured sodium concentration ranged from 5 to 175 mEq/L ( $r^2=0.987$ ), measured potassium ranged from 2.5 to 93.8 mEq/L ( $r^2=0.943$ ), measured calcium concentration ranged from 1 to 125.1 mg/dL ( $r^2=0.979$ ), measured magnesium concentration ranged from 1.2 to 38 mg/dL ( $r^2=0.891$ ), measured phosphorous concentration ranged from 5.5 to 132 mg/dL ( $r^2=0.919$ ). All p-values were  $<0.001$ . There were limits in how low the laboratory could measure. Values could not be lower than 5 mEq/L for sodium, 2.5 mEq/L for potassium, 1 mg/dL for calcium, 1.2 mg/dL for magnesium, and 5.5 mg/dL for phosphorous. The correlation of values also decreased as electrolyte concentrations reached higher values.

**Conclusion:** The laboratory measurements of sodium, potassium, calcium, and phosphorous were highly correlated with the calculated electrolyte ranges ( $r^2$  0.9). There was more variance seen with magnesium concentrations, but the values were still well correlated ( $r^2=0.891$ ). Ongoing quality assurance using laboratory analysis of electrolytes in PN can be used to provide confidence that the automated compounding device is set up correctly, thus reducing the risk of error and patient harm.

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**Category:** Quality Assurance / Medication Safety

**Title:** Outcome of medication safety officer preparatory course a Saudi experience

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**Purpose:** Medication Safety Officer Preparatory course is a recent intervention in the Saudi health care sector; it was designed to equip the practicing pharmacists with some knowledge and tools essential for the medication safety officer position in hospitals. The current study aims to assess the impact of this course on increasing the participating pharmacists knowledge toward medication safety general principles, and improving their practical and analytical skills necessary for such vital role.

**Methods:** A three days course was planned using a structured curriculum, to educate pharmacist about various issues, principals and tools on medication safety. The contents of this course has focused on the importance of the medication safety field in the health care system, through discussing the incidence of adverse drug events in the Saudi hospital setting, then reactive and proactive strategies to identify and prevent these adverse drug events ex. Root cause analysis, Failure mode and effect analysis, hospital medication safety self-assessment, and the role of hospital accreditation standards in improving safe medication practices. In addition to explaining and discussing the role of the medication safety officer position job description in promoting safe medication practices in hospitals. Pre and post- test to the pharmacists medication safety knowledge were done, using a twenty questions test. Data analysis was done using SPSS version 13 .

**Results:** Findings from two courses conducted in Riyadh, Saudi Arabia demonstrates significant increase in knowledge about medication safety concepts after the course educational sessions ( $p < 0.001$  \*  $Z = -3.955$ ). Demographic factors were not found to be associated with the increase in the attendees knowledge level. Linear regression modeling revealed that the course has found to improve the pharmacist knowledge about 60.0 % [ $Df=1$ ,  $R^2 = 0.607$ ,  $p < 0.001$  \*].

**Conclusion:** Medication safety officer preparatory course has resulted in a significant improvement in the pharmacist knowledge toward medication safety concepts, helpful in preparing pharmacist/s to a Medication Safety Officer position. Educating pharmacist on safety aspects of medication will be an effective approach to develop safety culture in the kingdom.

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**Category:** Quality Assurance / Medication Safety

**Title:** Lessons learned and actions taken after discovery of undetected information technology (IT) hazards within an electronic medication reconciliation pathway: Is your system at risk?

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**Purpose:** Medication reconciliation is a highly complex process that can present significant patient safety risks if not performed correctly and reliably. Implementation of electronic medication reconciliation systems can reduce the risk of error within these processes, however, new and unexpected information technology (IT) related hazards may be created. Surveillance of our voluntary electronic medical event reporting system revealed occurrences of inpatient medication orders for sustained-release/enteric-coated (SR/EC) medications which lost the SR/EC description (i.e. morphine SR 60 mg appearing as morphine 60 mg) on outpatient prescription forms and continuity of care documents (CCD) utilized to communicate information related to medication history during patient transitions of care. These changes to drug dose form descriptions were found to have occurred after final electronic approval of the order by the licensed independent practitioner (LIP), making the changes extremely difficult to detect. We will describe the lessons learned and actions taken to remediate these system failures in our electronic medication reconciliation pathway.

**Methods:** Pharmacy leadership and Pharmacy IT personnel participated on a multidisciplinary workteam charged with investigating the root causes of the identified issues and the development of an appropriate response plan. The Pharmacy team assisted in implementation of a process to notify over 6,000 patients who had been discharged on an affected medication over an 8 month period, including notification of the patient's primary care physicians of the CCD/prescription errors. The Pharmacy team assisted in development of an internal communication plan to alert physicians utilizing the electronic medication reconciliation pathway of the interim steps to be taken to prevent errors until a system fix was in place. The pharmacy software vendor was consulted and requested to develop a complete process map of flow of medication data fields through the medication reconciliation system. A pharmacist-led review of all 13,500 drug entries in the hospital's computerized prescriber order entry (CPOE) drug database was performed to compare the descriptions, dose forms and dose strengths (a total of 357,000 data fields) to that of the values expected to populate the corresponding data fields on the CCD/outpatient prescription. Pharmacists assisted in development of a plan to perform additional system testing to be performed by LIPs, pharmacists and nurses with support from IS personnel to validate system updates and to identify additional drug entries that may be problematic.

**Results:** The patient and physician notification process fortunately uncovered no patient harm that occurred due to incorrect CCD/prescription forms. The root cause investigation performed by Pharmacy and the Information Services (IS) department revealed that the unintended changes to drug descriptions, dose forms and product strengths were driven by the NDC number assigned to individual drug products within the CPOE drug database management system. The NDC number assigned to drug products in the internal CPOE drug database provides for clinical drug checking (e.g. drug allergy, drug interaction) within the CPOE system by a national drug information database, however, during medication reconciliation processing data fields from this national database were found to be overwriting CPOE supplied data on the CCD and prescription forms. The comprehensive pharmacist review of drug entries in the CPOE drug database identified 3,132 drug entries which were problematic and required further review. For issues where a high risk of patient harm was present (i.e. wrong drug description or dose printing on CCD/prescription), the Pharmacy IT team submitted requests for immediate updates to correct these drug entries and to assign appropriate alternative NDC numbers. For issues with low/no expected risk of patient harm or for which no immediate solution was readily identified, drug entries were placed in an electronic quarantine status within the CPOE drug database to ensure that the CPOE drug database descriptions/dose forms/strength were carried forward to corresponding fields on the CCD and outpatient prescriptions. Additional testing of 20 patient-based scenarios which included medication orders from actual inpatient ordering histories as well as all quarantined medications was performed in order to validate the system updates and the application of quarantine status to selected drug entries and resulted in 165 drug entries remaining in the quarantine status. A process for random auditing of system output on CCD and outpatient prescriptions by a pharmacist was developed to provide for ongoing system surveillance/quality assurance.

**Conclusion:** All system implementations involving medications, including ambulatory medications, must include pharmacy representation in the system design, analysis, and testing. Pharmacy leadership must develop a comprehensive understanding of the functionality of all systems related to medication management, including systems involved in medication reconciliation processes. Pharmacy leadership must engage Information Services (IS) leadership and partner to develop tools to provide a "source of truth" for drug information within clinical systems which clarify the effects of data entry processes on final system output. Ongoing system surveillance and auditing should be performed by pharmacists to assist in identifying post-implementation hazards with development of processes for assigning identified issues for appropriate follow-up and remediation.

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**Category:** Quality Assurance / Medication Safety

**Title:** Implementation of antimicrobial stewardship program in a community hospital

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**Purpose:** The inappropriate use of antibiotics, including the inappropriate selection and the extended duration of therapy, may lead to the emergence of resistant organisms and nosocomial pathogens. By promoting the appropriate selection, dosing, route and duration of antimicrobial therapy, an antimicrobial stewardship program plays an essential role in optimizing the clinical outcomes while minimizing the unintended consequences of antimicrobial therapy. This program was implemented to optimize the use and reduce the associated costs of antimicrobial therapy while improving the quality of care.

**Methods:** Several strategies, including antimicrobial restriction and audits and feedback to prescribers, were utilized. A multidisciplinary antimicrobial stewardship workgroup was developed and met on a monthly basis. An antibiotic orders form was implemented that requires all prescribers to specify the indication and duration of antimicrobial therapy. An automatic 7-days stop date was implemented for all antibiotics. A house-wide daily report for patients on 3 or more antibiotics was developed and distributed daily to the hospitalists and to clinical decentralized pharmacists. Extensive education was provided to the medical and nursing staff regarding the Antimicrobial Stewardship Program and the Antibiotic Orders Form.

**Results:** Baseline and ongoing data regarding four metrics were collected from March 2011 through November 2011. The rate of patients on antibiotics, multiple antibiotics, antimicrobial therapy for more than 14 days, and the cost of antimicrobial therapy were collected. Data showed a 29% reduction in the rate of patients on antibiotics, a 12% reduction in the patients on multiple antibiotics and a 27% reduction in the cost of antimicrobial therapy.

**Conclusion:** The implementation of the antimicrobial stewardship program was successful in improving the use of antibiotics while reducing the cost of antimicrobial therapy.

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**Category:** Quality Assurance / Medication Safety

**Title:** Optimizing smart infusion pump functionality to increase safety at point of administration in neonatal and pediatric populations

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**Purpose:** Among the reported medication errors, intravenous (IV) medications are the most commonly cited products involved in pediatric errors. Technology is often utilized throughout the medication-use process to make it more practical for healthcare providers to deliver safe care and to prevent potential medication errors. The purpose of this project was to optimize the current smart infusion pump functionalities through expansion of the drug library to include predefined administration parameters with the end goal of increasing the pump's error-prevention capability at the point of administration in neonatal and pediatric patients.

**Methods:** A current-state survey on the utilization and limitations of smart infusion pumps was administered to neonatal and pediatric nursing staff (n=144). Comments from the survey were incorporated into the redesigned drug library, which includes all orderable IV medications for the respective units, and maintained consistency with the computerized prescriber order entry (CPOE) system's pre-built orders and hospital formulary. Validated pediatric references were used to define administration parameters. Tall-man lettering was incorporated per the Food and Drug Administration (FDA) and Institute for Safe Medication Practices (ISMP) recommendations. The final drug library was reviewed by pediatric pharmacists and physicians, approved by the Pharmacy & Therapeutics Committee and transferred to all MedFusion 3500 series syringe pumps. Education was provided to all nurses prior to implementation. Four months post-implementation, a similar survey was administered to the nursing staff and continuous quality improvement (CQI) data was downloaded from the pumps for analysis.

**Results:** Responses from the current-state survey indicate that 84% of nurses (n=31) use smart infusion pumps as part of their daily workflow. Nearly 40% of nurses reported using the pumps preprogrammed safety administration software less than 25% of the time when administering medications by intermittent and continuous IV infusion. The most common barrier to use was absence of commonly prescribed medications from the current drug library. Suggested improvements included the addition of commonly prescribed IV medications and setting predefined safety parameters for all neonatal and pediatric medications. The drug library was redesigned with more than 200 items compared to 70 previously, uploaded to 86 pumps, and 144

nurses were trained prior to deployment. CQI data was obtained to document the impact of optimizing the functionality of the smart infusion pumps.

**Conclusion:** Expansion of the current drug library to include all orderable IV medications as well as setting predefined administration parameters optimized the error-prevention capability of existing smart infusion pumps at the point of care and increased use and satisfaction among nursing staff in the neonatal and pediatric units.

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**Category:** Quality Assurance / Medication Safety

**Title:** Continuity of care: unintentional discontinuation of chronic medications related to intensive care unit admission

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**Purpose:** Recent studies have reported that patients admitted to an Intensive Care Unit (ICU) experience excessive rates of unintentional medication discontinuation upon discharge. This study was designed to determine the incidence of unintentional medication discontinuation upon patient discharge from adult intensive care units at a 729-bed tertiary care academic hospital.

**Methods:** A retrospective chart review was conducted on adults admitted to the surgical, medical, cardiovascular, or burn ICU between June 15, 2011 and September 15, 2011. The study focused on patients that had been prescribed at least one medication from the following medications groups: thyroid hormones, antiplatelet or anticoagulant agents, HMG-CoA Reductase Inhibitors (statins), antidiabetic agents, respiratory inhalers, antihypertensives, antidepressants/antipsychotics, and gastric-acid suppressants. The primary outcome was the rate of unintentional medication discontinuation for each medication group studied. Information pertaining to intentional medication discontinuations was also gathered. This study was approved by the institutional review board prior to data collection.

**Results:** Three hundred sixteen patients were reviewed and 155 were included in the analysis. Patients were prescribed a total of 811 medications and four medications were unintentionally discontinued. The unintentional discontinuation rate for statins was 1.6%, for antiplatelet/anticoagulants 0.9%, antidepressants/antipsychotics 0.8%, and antidiabetic medications 1.4%. Unintentional discontinuations were more common in elderly patients with a longer length of stay. The unintentional discontinuation rates for this study and past studies were markedly different. However, a comparison of the potentially unintentional discontinuation rates from previous studies and the intentional discontinuation rates in this study found similar discontinuation rates. Thyroid hormones were discontinued intentionally in 13.6% of patients in this study; statins 19.6%; antiplatelet/anticoagulants 19.6%; acid suppressants 19.4%; and respiratory inhalers 10.6%.

**Conclusion:** The unintentional discontinuation rates of the studied medications were much lower than reported in previous studies. Previous studies' unintentional discontinuation rates were similar to the intentional medication discontinuation rates found in this population. Differences in the age, size, and type of population may account for the variance in unintentional discontinuation rates. Also enhanced transitions of care processes, communication and quality

improvement initiatives may also have contributed to differences in the unintentional discontinuation rates between this population and previous populations.

**Category:** Quality Assurance / Medication Safety

**Title:** Assessment of venous thromboembolism prophylaxis in adult medical inpatients after implementation of the computerized prescriber order entry (CPOE) system in a community hospital

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**Purpose:** To assess the impact of CPOE on providing venous thromboembolism (VTE) prophylaxis in adult medical inpatients compared with pre-CPOE manual tool use in a community hospital.

**Methods:** The National Hospital Inpatient Quality Measures-endorsed Consensus Standards for Hospital Care include VTE prophylaxis which is currently a voluntarily reported measure. Hospitalized patients are at high risk for deep vein thrombosis (DVT) and pulmonary embolism (PE). The risk factors for VTE include immobilization, advanced age, infection, malignancy, history of VTE, chronic lung disease, chronic heart failure, and others. So, since 2008, in our hospital-system, we have been using a manual VTE prophylaxis tool to assess the risk factors and provide appropriate prophylaxis to all eligible adult patients. Since September 2011, when we implemented a hospital-wide CPOE system, evidence-based Shared Baselines (electronic standard order sets) for VTE prophylaxis became available for the prescribers to assess the patients on admission for risk for VTE and provide appropriate prophylaxis. The objective of this study was to compare the VTE prophylaxis in adult medical inpatients pre-, and post-CPOE implementation in our 220-bed community hospital. This retrospective chart-review study compared VTE prophylaxis in one-hundred thirty nine (n = 139-pre-CPOE) adult medical inpatients during October and November 2008 with one-hundred thirty three (n = 133-post-CPOE) patients during April-May, 2012. The patients included in this study were those who were at least 18 years of age or older and who had two days or longer hospital stay in a medical unit. The patients from the intensive care, surgical, and dialysis units, and those on comfort measures were excluded from this study. The data collection included demographics, length of stay, VTE prophylaxis provided pre-, and post-CPOE implementation using assessment of risk factors. Appropriate VTE prophylaxis included pharmacologic (enoxaparin, unfractionated heparin, or warfarin) or non-pharmacologic (sequential compression devices, early ambulation) measures beginning on the day of or day after hospital admission. The percentages of compliance with the provision of appropriate VTE prophylaxis were calculated by traditional methods. Demographic data analysis included calculation of the mean, range and standard deviation (SD) by Microsoft Excel software. Chi-square method was used to evaluate the impact

of post-CPOE versus (vs.)-pre-CPOE implementation on the provision of VTE prophylaxis. P-value of less than 0.05 was considered significant for association. This study was exempt from the Institutional Review Board approval as a quality improvement project.

**Results:** The pre-CPOE arm of the study included 139 patients (males 43%, females 57%, mean age: 61.4 years (plus/minus SD 20.4)-range 20-95 years, mean length of stay: 6.3 days (plus/minus SD 3.9)-range 3-28 days. The post-CPOE group included 133 patients (males 37%, females 63%, mean age: 65.1 years (plus/minus SD 18.6)-range 18-98 years, mean length of stay: 6.2 days (plus/minus SD 5.8)-range 2-37 days. VTE prophylaxis was provided appropriately in 128 of 133 (96 percent) post-CPOE patients vs. 99 of 139 (71 percent) patients in pre-CPOE group (P less than 0.0005). In the pre-CPOE group (n =139), 69 of 74 patients (93 percent) who had risk-scoring done with the hard-copy of the VTE tool received VTE prophylaxis. The risk factor assessment tool was not used in 65 of 139 patients; however, 30 of these 65 patients (46 percent) also received appropriate VTE prophylaxis by prescribers own volition.

**Conclusion:** The implementation of the CPOE system in our hospital in 2011 has certainly helped us provide VTE prophylaxis in a majority of our adult medical inpatients which should help prevent venous thromboembolism and improve patient safety. It is of note that the compliance with appropriate VTE prophylaxis was also significant prior to the implementation of CPOE when the risk scoring tool was used. But, in a manual system with paper orders and scoring, it was difficult to ensure the use of the tool for all the patients. However, in the CPOE system, VTE prophylaxis evaluation was required and completed by the physicians for all the admissions resulting in very high compliance rate. We plan to share the results from this study with all our prescribers to achieve 100 percent compliance with this vital quality measure before January 2013 when reporting on the performance of this quality measure will become mandatory.

**Category:** Quality Assurance / Medication Safety

**Title:** Increased quality in documentation of medication reviews by use of a national database and a locally developed registration tool

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**Purpose:** Documentation of services provided by clinical pharmacists at Odense University Hospital, Denmark is continuously requested by the hospital board to ensure funding for the services. In 2009 to 2010, hospital pharmacists collaborated with the Danish Hospital Pharmacy Purchasing Company (Amgros) (a non-profit organisation) in developing a unique web-based drug-related problem (DRP) database for systematic registration of medication review data. The DRP-database was introduced at Odense University Hospital in 2011. However, it was necessary to operationalize the use of the DRP-database to ensure valid documentation. An existing local tool (HEKLAs criteria) for performing medication reviews had to be merged with the DRP-database. Hence the purpose of the study was to develop a data registration system, which could ensure systematic registration and satisfy the demands of the hospital board as well as contribute to national documentation of medication review.

**Methods:** The DRP-database is available to all hospital pharmacists in Denmark. The registrations are made for individual patients, and the patients appear non identifiable in the database. Thirteen DRP-categories are available with additional subcategories, and the relevant drug is coded according to the anatomic therapeutic chemical classification system (ATC). The Clinical Pharmacy Unit of Odense University Hospital (HEKLA) has developed a local evidence based tool for performing medication reviews called HEKLAs criteria, which are continuously revised to ensure clinical relevance. They were developed by adapting published criteria, e.g. Beers criteria, the START/STOPP criteria combined with Danish national guidelines etc. Currently, 79 HEKLA criteria exist. The HEKLA criteria, which were formerly arranged according to therapy area, were rearranged according to the thirteen categories of the DRP-database. On the basis of this, a registration sheet was made in order to facilitate unified systematic data registration in a clinical setting. An internal audit was conducted to evaluate whether using the registration sheet resulted in unified registration of data in the DRP-database.

**Results:** The following is an example of the contents of the registration sheet, which was developed. The DRP-category 'Dosage form and strength' with the DRP-subcategory 'intravenous administration could be replaced with oral administration of drug' is coupled with the HEKLA criterion F36 'Metronidazol infusion could be replaced by tablets because of metronidazols oral bioavailability of almost 100 percent'. 50 registrations on F36 produced by

nine pharmacists on six different wards were evaluated. The internal audit showed that the registrations were made 100 percent identical.

**Conclusion:** A data registration system was successfully developed. Systematic registration of data from medication reviews using the DRP-database is possible due to the rearrangement of HEKLAs criteria as well as the development of the registration sheet. This, in turn, makes it possible to compile valid documentation of clinical pharmacists efforts regarding medication review enabling pharmacists to meet the demands for documentation from the Odense University Hospital Board, which will hopefully result in increased funding of pharmacy services. Using a national database for registration of medication review data provides the possibility to contribute to national data collection and joined documentation nationwide, which may result in a national funding agreement in the future.

5-200

**Category:** Quality Assurance / Medication Safety

**Title:** Implementation of a drug safety alert program (DSAP) at Marshfield Clinic

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**Purpose:** With the large number of safety warnings communicated by the FDA, it is sometimes challenging for healthcare providers to incorporate this information into clinical practice. Marshfield Clinic is a multispecialty physician group practice in Wisconsin caring for more than 383,000 unique patients annually. With an integrated electronic health record, including an electronic prescribing platform, the Clinic is uniquely positioned to quickly identify individual patients and their respective prescribers when potential medication safety related alerts arise. The specific aim of this initiative was to develop a Drug Safety Alert Program (DSAP) at Marshfield Clinic to provide prescribers with up-to-date, timely and appropriate medication safety information while also identifying individual patients who are prescribed the medication of concern.

**Methods:** Medication safety concerns are identified by the Medication Safety Coordinator and Clinical Pharmacists through updates from the FDA and peer reviewed literature. The Clinical Pharmacy Services team gathers relevant clinical and medication utilization data regarding the potential safety concern. Characteristics which are reviewed include severity of illness being treated, severity of risk identified, size of population, available alternatives, comparative cost of alternatives and identification by national patient safety organizations. Functioning under Marshfield Clinics Institute for Quality, Innovation, and Patient Safety (IQIPS), the Drug Evaluation Committee (DEC) plays a critical role in review of safety alerts. DEC members review the information presented by clinical pharmacists to determine the level of communication (e.g., system communication to all prescribers, letters to targeted prescribers, and/or letters to patients). Written communications are sent to prescribers and patients, safety information is added to the electronic prescribing platform, information is communicated in the monthly system-wide pharmacy newsletter, and pharmacy staff members are provided with further education regarding the safety warning. Communication is targeted to those prescribers who have been identified as generating an electronic prescription for the individual medication with targeted dose, diagnosis, interaction, etc. Letters are distributed to prescribers outlining the detail of the safety information and including a list of patients for whom they have prescribed the medication in the last 15 months.

**Results:** In its first year, Marshfield Clinic DSAP has involved six medications (topiramate, glyburide, simvastatin, citalopram, pioglitazone and lovastatin). Five of the six medications (topiramate, glyburide, simvastatin, citalopram, pioglitazone) have baseline and follow-up data available at this time. Over 10,000 potentially problematic patient/medication combinations were identified at baseline. At individual follow-up evaluations, approximately 54% (5,515) potential adverse drug events have been resolved. The most significant change was observed with citalopram doses greater than 40 mg/day which may increase risk for QT prolongation. Eight-two percent of patients originally identified receiving prescriptions for citalopram greater than 40 mg/day were now at, or below, the new recommended maximum dose or changed to alternative therapy.

**Conclusion:** The Drug Safety Alert Program has shown to be an effective means to communicate relevant medication safety information to prescribers. In addition, DSAP provides the prescriber with a list of patients who may require further clinical evaluation to ensure safe use of medications. Other healthcare organizations with integrated electronic medical records and/or pharmacy records may be able to leverage their electronic prescribing data to create a similar medication-use safety program. Future direction includes scoring of various characteristics (e.g., severity of illness, severity of risk, size of population) of the safety warnings to standardize the inclusion or exclusion in DSAP.

5-201

**Category:** Quality Assurance / Medication Safety

**Title:** Smart infusion pump continuous quality improvement in a specialty hospital

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**Purpose:** Electronic intravenous infusion devices with dose error reduction software, i.e. smart pumps, are reported to decrease the likelihood of serious medication errors related to intravenous infusions. Smart pump infusion devices have been utilized at Womans Hospital since 2006 to administer drugs in a safer way to adults and neonates. The development of the drug library includes input from nursing, pharmacy, and the medical staff. After successful implementation of a smart infusion pump with wireless technology in 2008, usage was reviewed and trended to identify potential library improvements and error prone workarounds.

**Methods:** Quality improvement reports were utilized to track the success of library changes at approximately six month intervals. These reports were reviewed by nursing, pharmacy and the medical staff when applicable to identify potential library revisions that minimized nuisance alerts, added new medications, and updated drug limits. Infusion device issues revealed library weaknesses which led to the creation of a separate clinical care area for parenteral nutrition and to the strengthening of the volume to be infused (VTBI) limits for many drugs. The adult smart pump library was updated three times since implementation in 2008.

**Results:** Key indicators, such as potential errors prevented and the smart pump alerts per pump program, improved as a result of library revisions. Potential errors prevented were identified as an edit to either a soft or hard limit alert. The percentage of potential errors prevented per alert increased from 28% to 48% from 2009 to 2012. The smart pump alerts per pump program was 4.33% in 2009 and decreased to 2.3% in 2012. The percentage of programming outside of drug safety limits was 0.7% in 2009 and decreased to 0.5% in 2012.

**Conclusion:** The continuous quality improvement process applied to smart infusion pumps led to the successful decrease of nuisance alarms and enhanced patient safety. These changes are reflected by the sustained increase in potential errors per alert and by the sustained decrease in alerts per pump program.

5-202

**Category:** Quality Assurance / Medication Safety

**Title:** Expansion of a system-wide standardized pharmacy medication history program to all emergency department visits: a baseline evaluation

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**Purpose:** An accurate medication history is the foundation of effective medication reconciliation. Previously, it has been shown, medication errors are reduced if pharmacy completes the medication history versus another member of the healthcare team. The purpose of this study was to define the baseline accuracy and completeness of current medication histories completed by nursing for all emergency department visits in a 5 hospital health system prior to expansion of an existing pharmacy medication history program to all emergency department visits. Accuracy and completeness is defined based on a Pharmacy and Therapeutics committee approved Pharmacy Medication History Standard.

**Methods:** Between May 9, 2012 and June 4, 2012 a total of 142 medication histories were obtained from 71 patients visiting one of five Cone Health emergency departments with at least 1 home medication, regardless of pending admission status. Each patient had a medication history completed by nurse and a pharmacy technician. Medication histories were scored for accuracy and completeness using a rubric based on the Cone Health Pharmacy Medication History Standard. The accuracy score summarizes the correct documentation of information, e.g. dose, formulation, and frequency based on patient report. The completeness score summarizes the completion of required documentation of key medication history elements including allergies and complete medication information. Demographic data was collected for each patient.

**Results:** The accuracy rate for a standardized medication history completed by pharmacy was 91.1% (+/- 0.2) versus 18.1%(+/-0.3) for nurses ( $p<0.0001$ ). The completeness rate was also significantly better for the standardized pharmacy history versus nursing (95.3% (+/- 0.1) versus 51.4%(+/- 0.2)  $p<0.0001$ ). Patients were on an average of 7.1 (+/= 5.6) medications and 46% were admitted.

**Conclusion:** These results highlight the value of the Pharmacy Medication History Standard for delivering a consistently accurate and complete medication history. The consistent quality of the pharmacy medication history program at Cone Health has resulted in the expansion of this program to all emergency department patient visits system wide.

5-203

**Category:** Quality Assurance / Medication Safety

**Title:** Implementation of a pharmacist-managed medication order and compounding card filing system to reduce missing doses in an urban tertiary teaching hospital

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**Purpose:** The occurrence of missing or late doses remains a challenge for all healthcare providers and in particular pharmacy departments. The process of tracking doses and/or regimens from the time an order is placed to the time it is dispensed and administered to a patient is cumbersome and time-consuming, with many steps along the way. The process becomes costly when doses are lost and wasted later or when a patient must wait longer in a clinic chair. The goals of this project were to decrease the number of missing doses and potentially minimize delays in treatment of inpatients and outpatients receiving expensive investigational or higher profile medications, compounded narcotic infusions and medications which are time-intensive to procure and/or prepare.

**Methods:** A wall-mounted filing system was strategically placed in a central location of the pharmacy where it would be highly visible to pharmacy staff. Time-sensitive pending medication orders were collected by the centralized pharmacist and placed into the filing system based on hour due regardless of date to be administered. A slot was designated for patients receiving medications in short supply or on backorder. To track doses after they were dispensed, a medication compounding card was prepared to record pertinent information such as patient name, location, drug name, diluent, lot number, expiration date and time dispensed. If subsequent doses were required, the compounding card would be placed back into the filing system for the next time it would be due. All pharmacists and pharmacy technicians were trained by the centralized pharmacist to be cognizant of the new procedure.

**Results:** The newly implemented filing system was well-received by pharmacy staff and use of such has made it easier for pharmacy to locate pending paper orders. Pharmacy staff members report that they spend less time searching for pending orders and missing doses. Information detailing how and when doses were compounded or dispensed is also readily retrievable.

**Conclusion:** The development of an organized medication order and compounding card filing system was an effective way for staff to readily locate pending orders, prepare doses on time and decrease missing doses.

5-204

**Category:** Quality Assurance / Medication Safety

**Title:** Implementation of outpatient pharmacy near-miss medication errors documentation program

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**Purpose:** Documentation of near-miss medication errors is necessary to determine education that can be completed and processes that can be changed to prevent near-miss or actual medication errors in the future. Nothing was in place to document these outpatient near-miss errors prior to the outpatient supervisor's arrival in June 2011.

**Methods:** A tear-off pad of Drug Therapy Review sheets was created for each outpatient pharmacist to utilize during the verification process of prescriptions for either window or mail processing. The pharmacist would start documentation on the sheet, then finish it after communicating with the prescription writer. The outpatient supervisor collected the sheets and compiled them on an access table for quarterly review. These were presented at hospital Patient Safety and Quality Management meetings.

**Results:** The pharmacists collected 3758 interventions involving more than 350 providers during the first year. It was quickly apparent that the physicians in outlying clinics were producing almost 33% of the near-miss errors. Group training was provided during a face-to-face meeting of outlying clinic providers, individual training was provided at the work site and feedback was given to the clinic managers each quarter on the individual providers' interventions. As a result, the providers decreased their problem orders by 25%. Interventions decreased from 79 to 32 which was a decrease from 6.2% to 2.9% of all interventions over one quarter at one of the clinics. The medical residents represented another group with a high number of interventions, 13% of total reported for the year. Due to the reported number of potential errors, pharmacy was given the opportunity to present materials on CII writing, non-formulary and requested medications, and use of the antibiotic template during the resident orientation in July 2012. Laminated cards with instructions on writing CII prescriptions were created for providers to hang on ID card lanyards. These were distributed at resident orientation and when new physicians registered for prescription pads and served as memory joggers. Blow-ups of the cards were placed in all medication rooms throughout the hospital.

**Conclusion:** Documentation of potential medication errors allows for opportunities to provide education and make process changes to prevent potential errors from becoming actual errors. Staff turnover provides continued training and feedback opportunities.

5-205

**Category:** Quality Assurance / Medication Safety

**Title:** Implementation of a pharmacist-based medication reconciliation program upon discharge in patients admitted with heart failure to a community teaching hospital

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**Purpose:** Proper medication reconciliation upon hospital discharge is important to reduce harmful errors, optimize therapy and potentially decrease hospital readmissions. It is known that approximately 70% of patients receive erroneous, incomplete or incorrect medication instruction upon discharge from the hospital.<sup>1</sup> This is of particular concern for patients with heart failure where continued adherence to an optimal regimen is important in decreasing morbidity and mortality. To address the issue, a pharmacist-based medication reconciliation program was implemented for 82 of the 159 medical-surgery beds at South Pointe Hospital. The purpose of this study was to evaluate the effectiveness of medication error reduction through pharmacist-based medication reconciliation in patients admitted for heart failure. 1.Foust, J.B., Naylor, M.D., Bixby M.B. and Ratcliffe, S.J. (2012). Medication problems occurring at hospital discharge among older adults with heart failure. *Research in Gerontological Nursing*, 5(1), 25-33.

**Methods:** Approval was first obtained from our Institutional Review Board. The study was a retrospective chart review of all patients over 18 years of age with a primary diagnosis of heart failure (ICD-9, 428) discharged to home from October 28, 2011 through February 29, 2012. Patients that left against medical advice, had incomplete discharge instructions or incomplete charts were excluded. All discharge instructions had been reconciled initially by the attending physician at time of discharge in the electronic medical record (EPIC MyPractice). Further medication reconciliation and hardcopy printouts were performed and created by either a pharmacist or discharge nurse and given to the patient at discharge. Copies of the actual printouts were obtained and evaluated by a single reviewer for completeness and clinical correctness in accordance with their medical record. The primary outcome measure was a comparison of the percentage of patient medication instructions with any error when medication reconciliation was performed by a pharmacist versus a discharge nurse. Classification and proportions of medication error were performed as secondary outcomes. Chi-square analysis was used to evaluate the primary outcome.

**Results:** In total, 70 patients were identified. Of these patients, 31 received medication reconciliation by a pharmacist and 39 received standard medication reconciliation performed by a discharge nurse. For the primary outcome the percentage of patient discharge instructions with

at least one error was similar for both groups (43.6% vs. 41.9% in the nurse and pharmacist groups respectively ( $p>0.05$ ,  $\chi^2=0.019$ ). The total number of errors found when medication reconciliation was performed by a nurse was 47, whereas 25 total errors were found when reconciliation was performed by a pharmacist (proportionally, 1.2 errors per chart in nurse discharge vs. 0.8 errors per chart in pharmacist discharge). The category with the largest proportional difference was found as incomplete or incorrect medication instructions (0.38 in standard discharge vs. 0.09 in pharmacist discharge). Additional proportional differences were also found in the incorrect dose (0.25 in standard vs. 0.19 in pharmacist) and omitted medication (0.154 standard vs. 0.097 in pharmacist) categories. No differences were found in obsolete medication, incorrect medication and duplicate medication categories.

**Conclusion:** This study did not find the primary outcome to be statistically significant; however the pharmacist discharge reconciliation program reduced the total proportion of errors contained in patient home medication instructions including the specific categories of dose, instruction and omissions. Compared with similar studies reporting 70% error rates at discharge, the percentage of errors found in our nurse discharge process was much lower than expected.<sup>1,2</sup> This finding may have contributed to the lack of statistical significance. It is possible that the relatively low rate of errors is due in part to improved physician familiarity with the medication reconciliation process at discharge since initiation of computerized physician order entry began in July, 2011. Staff pharmacist decentralization to the nursing floors occurred during the same time period and may have further contributed to overall lower error rates. As hospital reimbursement correlates more closely with readmission rates, the reduction in overall medication errors in heart failure patients will continue to be a priority. Pharmacist involvement can help prevent medication errors and potentially reduce readmission rates for heart failure patients. 1.Foust, J.B., Naylor, M.D., Bixby M.B. and Ratcliffe, S.J. (2012). Medication problems occurring at hospital discharge among older adults with heart failure. *Research in Gerontological Nursing*, 5(1), 25-33. 2.Wong, J.D., Bajcar, J.M. and Wong, G.G. et al. (2008). Medication reconciliation at hospital discharge: evaluating discrepancies. *Annals of Pharmacotherapy*, 42(10), 1373-1379.

5-206

**Category:** Quality Assurance / Medication Safety

**Title:** Incidence of thromboembolic events after the use of recombinant factor VIIa at a veterans affairs medical center

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**Purpose:** The goal of this retrospective study was to determine the incidence of thromboembolic events after the use of rFVIIa at the San Francisco Veterans Affairs Medical Center (SFVAMC). The doses and indications for rFVIIa use at the SFVAMC were identified. Patients were assessed for risk factors that may have increased the risk of thrombosis.

**Methods:** The institutional review board approved this retrospective chart review study of patients that were administered at least one dose of rFVIIa at the SFVAMC within October 1, 2001 to September 30, 2011. Correlation between thromboembolic events and factors such as the dose of rFVIIa, the indication, and the patients comorbidities were evaluated.

**Results:** There were 147 patients that received rFVIIa at SFVAMC during the study period. Of the 147 patients, 103 patients had known 30 day outcomes. The rate of thromboembolic events within 30 days of receiving rFVIIa was 9% (9/103). Of the 147 patients who received rFVIIa, the indications for use were bleeding associated with cardiac surgery (n=116, 79%), surgery of a non-cardiac type (n=9, 6%), intracranial hemorrhage (n=10, 7%), hemophilia (n=3, 2%), INR reversal (n=2, 2%), and other types of bleeding (n=7, 5%). The average dose of rFVIIa overall was 67.5 mcg/kg after excluding one outlier patient who received the labeled dose of 90 mcg/kg every two hours (total of 874 mg) of rFVIIa. The risk factors assessed did not appear to cause an increased risk of clot.

**Conclusion:** The rate of thromboembolic event at the SFVAMC for patients who received rFVIIa within 30 days was 9%. The most common indication for rFVIIa is bleeding associated with cardiac surgery. Other indications include bleeding associated with surgeries of a non-cardiac type, ICH, INR reversal, other types of bleeding, and hemophilia. The average dose of rFVIIa used was generally lower than the dosing recommended for the FDA labeled indication. It is unclear which risk factors increased the risk of thromboembolic event after the use of rFVIIa.

5-207

**Category:** Quality Assurance / Medication Safety

**Title:** Reduction of adverse events as measured by the Institute of Healthcare Improvement (IHI) Global Trigger Tool in a pediatric and two adult hospitals over two years

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**Purpose:** The IHI Global Trigger Tool for Measuring Adverse Events is designed to identify adverse events (harm) and measure the rate of harm over time. The purpose of this study is to compare the rate of harm from baseline to 2 years using the IHI Trigger Tool in a pediatric hospital and in data representing two adult hospitals. Severity of harm and whether or not the adverse event (AE) was present on admission or is medication related is also characterized.

**Methods:** A modified version of the IHI Global Trigger Tool was utilized. Adverse events per 1,000 patient days (harm rate) was compared at baseline to 2 years for a pediatric hospital and two adult hospitals. The Mann-Whitney U Test was performed with a significance level of 0.05. The National Coordinating Council for Medication Error Reporting and Prevention Index for Categorizing Medication Errors was used to categorize the severity of harm.

**Results:** The harm rate in the pediatric hospital decreased significantly from baseline (59.9) to two years (31.3) (P equals 0.005). 70 percent of the pediatric AEs were categorized as temporary harm requiring intervention and 30 percent were categorized as temporary harm requiring initial or prolonged hospitalization at both baseline and at two years. The pediatric data indicated that 51 percent of the AEs were medication related and only 19 percent were present at admission at baseline. At two years, 47 percent of the AEs were medication related and only 22 percent were present at admission. The harm rate in the data combined for the two adult hospitals also decreased significantly from baseline (114.4) to two years (74) (P equals 0.008). The adult data revealed similar severity of harm as the pediatric data. 48 percent of the adult AEs were medication related with 26 percent present at admission at baseline. At the two year mark, 37 percent were medication related and 33 percent were present at admission.

**Conclusion:** The harm rate as determined by the IHI Trigger Tool significantly decreased from baseline compared to two years in a pediatric hospital and in data representing two adult hospitals. Reasons for the decrease in the harm rate are unclear but may include the implementation of safety culture transformation, computerized provider order entry, bar code medication administration, and other safety initiatives.

5-208

**Category:** Quality Assurance / Medication Safety

**Title:** Bar-code medication administration: pharmacy's key role in the medication safety process

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**Purpose:** The institution of Bar-Code Medication Administration (BCMA) to decrease medication error rates has been widely documented. Having the correct medication available for administration and acceptance of the BCMA technology is necessary for the process to be effective and avoid workarounds at the bedside. The bar-coding system must be efficient and accurate in order to recognize medication safety benefits. The pharmacy plays a pivotal role in assuring that this system is developed and maintained. Multiple checkpoints need to be implemented within the medication procurement and distribution process to assure positive outcomes.

**Methods:** Initial population of the bar-code data base with primary NDC for each pharmacy item is the foundation for the system. Once the primary database is in place the process of linking all other generic medications for each pharmacy item to primary NDC is set up to assure that the medication ordered and the bar-codes match at the time of administration. The first checkpoint is to scan each item to verify that it is in the data base when the medications arrive in the pharmacy prior to being added to the general pharmacy stock. Any bar codes that do not match are set aside and manually entered into the system along with any items that do not have barcodes. For those items that do not have manufacture bar codes, pharmacy generates a unique bar-code prior to release to the general stock. Monitoring the percent usage and overrides at the administration level is the final check point in the system.

**Results:** The percentage of medications administered with bar-code checking has improved from an average of 85.7% to 92.9% hospital wide in the first 9 months of using BCMA. The number of medication events reported 12 months prior to the initiation of the system was 272 with 49 classified as harmful (18%). For the first 12 months of utilizing the system there were 291 events reported with 22 classified as harmful (7.6%), presenting a decrease of 59%. Literature has suggested an associated cost of \$8,700 per harmful event. A cost savings of \$234,900 for the first 12 months of the system was realized.

**Conclusion:** The institution of a well built and properly maintained bar-code system improved the safe and cost effective administration of medications in a community based hospital.

5-209

**Category:** Quality Assurance / Medication Safety

**Title:** Role of pharmacy students to improve screening for vaccination

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**Purpose:** Starting in 2012, CMS and the accreditation agencies developed two hospital measures as a replacement for the diagnosis specific immunization measures. The two Immunization measures became effective as of January 2012 and applied to all hospitalized inpatients. The immunization measures include: overall rate for pneumococcal immunization; in patients 65 and older and in high risk populations 6 through 64; and in overall influenza immunization. While the broadened scope of patient population may present a challenge for institutions, this is an opportunity for the pharmacists and students to get involved. In our institution, nurses are able to screen, order and vaccinate eligible patients. However, there continues to be opportunities for improvement. The purpose of this project is to delineate the role that pharmacy students can play in vaccination screening for inpatients.

**Methods:** Under the supervision of an Internal Medicine Clinical Pharmacist, students completing a P4 rotation in Internal Medicine at our institution were responsible for the daily selection of three to five patient medical records on an inpatient nursing unit. Charts were audited for inclusion of a mandatory pneumococcal/influenza vaccine standing order form. If incomplete, a blank order form was obtained, and the chart was reviewed for the various components required to be completed. After completion of the form, the student placed the form in the chart, flagged for the nurse to review and, if available, personally spoke with the nurse in regards to the vaccination status of the patient. Data was collected regarding the number of patient charts reviewed, number of incomplete forms, and number of patients for whom forms were completed and placed in the medical record by students.

**Results:** In a three month period, 150 patient medical records were reviewed. An order sheet was incomplete for 67/150 (44.7%) patients. In each of these instances, a form was completed by the student for review and signature and in 27/67 (40%) cases, the pharmacy student spoke with the nurse caring for the patient. Of the patients for whom an order sheet was not available, 35 patients (35/67, 52.3%) had indications for vaccination and did not meet any of the exclusion criteria.

**Conclusion:** Participation of pharmacy students contributed to compliance with hospital screening requirements. This initiative will continue to improve identification of inpatients who may be candidates for influenza and/or pneumococcal vaccination. The impact on the CORE measure will be assessed.

**5-210**

**Category:** Quality Assurance / Medication Safety

**Title:** Impact of a pharmacist on a core measures team

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**Purpose:** Core measures and the Surgical Care Improvement Project (SCIP) are evidence-based, scientifically-researched standards of care which have been shown to result in improved clinical outcomes for patients. Along with improved patient care, core measures compliance offers hospitals increased reimbursement from Medicare due to value-based purchasing (VBP). Boca Raton Regional Hospital (BRRH), is a single, non-for-profit hospital with a 67% Medicare population. In January 2011, the hospital formed a core measure team to focus on various areas of improvement. In April of 2011, Senior Administration approved two additional full-time clinical pharmacy positions to focus on areas of improvement, with an effective date of July, 2011. The impact of the core measures team and pharmacy process improvement methods will be presented.

**Methods:** A multidisciplinary core measures team met weekly beginning in February 2011 to discuss core measures and SCIP improvement areas. The team consisted of nursing leaders, the Chief Medical Officer, the quality management department, pharmacy, and health information management. Allowable pharmacist documentation from CMS was reviewed and presented, and protocols passed at Pharmacy and Therapeutics and Medical Executive Committees. Training of the protocols and core measures/SCIP to the newly-hired clinical pharmacists and staff began in May of 2011, in preparation for July 1, 2011. Hospital performance rates were compared between July 2010-March 2011, and July 2011-March 2012. The impact of pharmacy core measures and SCIP interventions and processes are documented and described.

**Results:** Core measures and SCIP compliance increased in all areas after pharmacist involvement in July 2011, with the exception of the pneumonia core measure. During July 2011-March 2012, the hospital performed at 100% in all areas where the pharmacist made the greatest number of interventions. These included the acute myocardial infarction, heart failure, and SCIP measures. In addition, BRRH scored 100% in 3 out of the 4 measures associated with venous thromboembolism (VTE) during the period of clinical pharmacist involvement. In July 2011-March 2012, BRRH fell into the category of top 10% of hospitals, thus optimizing financial reimbursement while maintaining optimal patient care.

**Conclusion:** Core measure compliance and SCIP is becoming increasingly more important to hospitals due to value based purchasing and Medicare reimbursement. BRRH is unique in that two clinical pharmacy core measure positions were recently approved to assist in screening and

documentation. The pharmacy interventions as well as the core measure team and process improvement areas have had a tremendous impact on improving core measure compliance and providing quality care for our patients.

5-211

**Category:** Quality Assurance / Medication Safety

**Title:** 911: Re-dispense with discretion

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Neelam Vyas

**Purpose:** Missing medications are a challenge faced by pharmacists and nurses daily in hospital practice. Simply re-dispensing missing medications without question or investigation is one of the ways pharmacy staff resolve this challenge. Sometimes re-dispensing is truly warranted when a thorough investigation of the missing dose is conducted. However, the problem lies in the fact that far too often re-dispensing is used because it is easier and accepted as part of the pharmacy/nursing culture. It has been observed at South Pointe Hospital that re-dispensing with discretion can significantly impact the pharmacy not only financially but also on many other levels. Since we were able to include discretionary re-dispensing as part of our practice, we would like to encourage other hospitals to use this practice model. This model provides proactive solutions to prevent future missing medications rather than reactively re-dispensing and has the potential of becoming a hospital pharmacy standard of practice.

**Methods:** The data was collected on a voluntary basis during the usual day to day operations. One day shift pharmacist and one evening shift pharmacist participated in the data collection. A pharmacy technician was occasionally called upon to assist when time allowed. While determining the root cause of the missing medications, an algorithm was developed. This algorithm was followed to troubleshoot any future missing medications. All dosage forms were included in this project. We were able to further extrapolate this data to meaningful and useful endpoints. These endpoints include problems with our current drug delivery system, medication delivery location, and patient transfer process. Along with the operational component, valuable clinical applications such as drug therapy monitoring and lab value monitoring were also used in determining whether to re-dispense the missing medication. After the missing medication was either found or re-dispensed a savings or cost was determined.

**Results:** The data was collected intermittently over a seven month period. The data showed conclusively that an overall financial savings to the hospital could be realized. Of the 304 occurrences that we investigated 229 medications were found and 75 medications were re-dispensed. This translates into 75% of missing medications being found. The medications that were found totaled \$5,906.10. Those medications that were not found and thus re-dispensed cost the hospital \$1,771.58. The overall savings to the hospital was \$4,134.52.

**Conclusion:** Even though we were not able to investigate all occurrences, our small sample size (84 days out of 365 or 23%) was still able to realize a considerable overall savings to the hospital. This project was originally designed to show how discretionary re-dispensing could

have a positive financial impact. We soon realized that this model encompassed so much more. Benefits of this practice model include financial savings, inventory control, environmental waste reduction, efficiencies in work flow and time, as well as patient safety in line with ASHP 2015 goals.

5-212

**Category:** Quality Assurance / Medication Safety

**Title:** Benefits of performing a thorough formulary review prior to barcode implementation

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**Purpose:** With the increasing demands on pharmacy resources, formulary review is often at the bottom of a long list of priorities. Our 100 bed hospital is in a small community and has considerable technology including CERNER based computerized physician order entry (CPOE), electronic medication administration record (eMAR), and automated dispensing cabinets (Pyxis). In the interest of safety, we are implementing a bar-code system at the unit dose level. To allow for as smooth a transition as possible, the first step was to perform a line-item review of the formulary to ensure it reflected current pharmacy inventory and needs. We also hoped to discover additional benefits in the process by ensuring our formulary included only products in our actual physical inventory.

**Methods:** A current formulary was printed from our Pyxis station and, to our surprise, it consisted of 1834 items. Next, a comparison was done between the printed formulary and the items actually on our shelves, marking all of the items which were no longer physically stocked in the pharmacy. One pharmacist then went through the remaining items listed on the formulary to mark those items which could potentially be removed due to duplication, no longer being manufactured, no longer stocked, or lack of use. This list was then reviewed by all the staff pharmacists to determine which items could be removed from the formulary. Once a consensus was reached, the chosen items were then either immediately removed from the Pyxis formulary and pharmacy stock or allowed to outdate prior to removal. Once an item was removed from the Pyxis formulary it was then deleted in the CERNER formulary to prevent it from being ordered through CPOE.

**Results:** By reviewing the inventory item by item, a total of 536 items were able to be removed from our formulary. Only 25 items were removed due to lack of use. Another 31 items had been discontinued by the manufacturers and 166 items were removed due to duplication (i.e.: having similar items stocked and multiple strengths not needed). A surprising 314 items were simply no longer part of our physical inventory. Based on the inventory from the previous year, over 3300 unit dosed products were removed from stock for a total cost savings of over seven thousand six hundred dollars. This resulted in a reduction in the time for daily inventory activities, including medication ordering, pharmacy inventory processing, unit dosing, and Pyxis fills.

**Conclusion:** By undertaking a detailed evaluation of our formulary we were able to reduce our inventory by 29.2 percent and, in doing so, reduced costs associated with a larger inventory. An expected consequence is a reduction in medication errors when products are selected via CPOE, verified by the pharmacist, and ultimately dispensed from the automated dispensing cabinet. We also noticed a reduction in time required to process inventory. Ultimately, we also accomplished

our original objective of increasing the accuracy of our inventory prior to barcode technology implementation.

5-213

**Category:** Quality Assurance / Medication Safety

**Title:** Development and evaluation of safety interventions to reduce distractions during medication administration process

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**Purpose:** The nursing work environment is inseparably connected to the concept of safety and quality of the patient care. Of major importance for good patient care practice is the process of medication administration that, by volume and complexity, is one of the most demanding tasks that nurses complete. Numerous studies have shown that interruptions and distractions during medication administration are strongly associated with an increased risk in medication administration errors. Therefore, reducing unnecessary interruptions and distractions of nursing staff is critical for diminishing medication errors. This study focused on two specific aims: (i) identification of safety interventions that could reduce distractions/interruptions and (ii) evaluation of the effectiveness of the identified interventions. A total of 755 interruptions and disruptions have been identified during the 183 observation sessions that were conducted during the medication administration process in six nursing units of the Cleveland Clinic.

**Methods:** Several safety interventions have been developed in collaboration with the nursing staff leadership and trialed on two adult nursing units of the Cleveland Clinic. Specifically, these safety interventions/measures were: (1) establishing the Quiet Zone around Pyxis MedStations, (2) developing an education pamphlet for patient/family (3) defining a medication-pass time out process, and (4) implementing a series of visual cues such as Do not disturb door signs, and red-badge on a red lanyard during medication administration. The various measures were introduced to the nursing staff during daily in-service sessions and piloted for 3 months. During the pilot phase, brief spot checks were conducted to assess the adherence of nurses to the implemented interventions. Additional educational sessions were organized, as needed. Also, a checklist for nurses was developed to facilitate an accurate implementation of these interventions. The effectiveness of the safety interventions was evaluated during a post-implementation observational study. Interruptions/distractions were documented during stepwise observations of nurse activity during the medication administration process.

**Results:** After introducing the mentioned safety measures the overall interruption/distraction rate decreased by more than 50%, from 4.4 pre-intervention to 2.0 post-intervention. The specific sources of interruption/distractions impacted by the implementation of the safety interventions were: other personnel, loud conversation in the medication room, patients and external noise. The creation of the Quiet Zone around Pyxis MedStation decreased the other personnel interruptions, which was the largest source of interruption before the intervention. The red-badge on a red lanyard placed around the computers-on wheels created awareness on the unit for the medication administration process. The do not disturb in conjunction with closing the door, when

used, reduced the ambient noise to significantly lower levels and insured a minimization of the traffic in the room while medications were administered.

**Conclusion:** A multifactor approach was successful in reducing the interruption/distractions rate. The changes process requires team work and the transition to the new practices takes time and effort.

5-214

**Category:** Quality Assurance / Medication Safety

**Title:** Impact of executive support on medication safety and regulatory compliance in hospital clinics

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**Purpose:** The main objective was to increase hospital clinic adherence to both the Joint Commission standards and Department of Health regulations on medication management. The intent was to improve patient and medication safety through proper medication storage area upkeep and ensuring that medications stored in these areas were adequately prepared for storage.

**Methods:** A piloted inspection surveillance of four hospital clinics (Nuclear Medicine, Infusion Oncology, Occupational Health, and Radiology) was conducted from January 2011 to February 2012. The pharmacy inspection team made recordings on unit inspection forms on a monthly basis. Some of the Joint Commission standards that the forms prompted examination of included but were not limited to the following: medications are properly stored (MM.03.01.01), emergency medications are safely managed (MM.03.01.03), medications are safely prepared (MM.05.01.07), medications are properly labeled (MM.05.01.09), returned medications are safely managed (MM.05.01.19), and investigational medications are safely managed (MM.06.01.05). In early 2011, an executive intervention was introduced by the medication safety officer in order to extend the inspection review privileges to a wider hospital employee base. Prior to this time, inspection findings were reviewed exclusively by the Pharmacy department (the inspection technician and the medication safety officer). During months of March and April 2011, the medication safety officer, the assistant vice president of ambulatory practice operations, and the vice president of professional and surgical services visited the hospital clinics to carry out inspection. After direct observations and recommendations were made, a process change was implemented on April 5, 2011. The new process change involved emailing inspection reports, the findings, along with the suggestions for plans of action to all key stakeholders (clinical supervisors, nurse managers, administrators, director of pharmacy, assistant vice president, and vice president) of inspected units.

**Results:** According to the 14 months of data collection, there was an average increase of 25% in regulatory compliance after executive interventions. Specifically, the compliance increased 69% for Nuclear Medicine, 25% for Radiology, 5% for Occupational Health, and 3% for Infusion Oncology. Before executive intervention (January 2011-April 2011), the average compliance

was 48% for Nuclear Medicine, 76% for Occupational Health, 86% for Radiology, and 95% for Infusion Oncology. After executive intervention and being key players of the inspection process during May 2011 through February 2012, the average compliance was 86% for Nuclear Medicine, 76% for Occupational Health, 89% for Radiology, and 95% for Infusion Oncology. Executive intervention made a significant impact on clinics that had very low regulatory compliance while it made less of an impact for clinics with documented and well established regulatory compliance. Executive intervention contributed to the sustainability of compliance for all evaluated hospital clinics.

**Conclusion:** Although some of the studied clinics were not significantly impacted by the executive intervention, the trend in compliance improved in the later months of the surveillance period for all four inspected units. Active involvement of hospital leaders and executive staff in inspection review of the selected units has improved regulatory compliance, and such action will be extended to other onsite and offsite hospital clinics. Broadened involvement in hospital unit monitoring led to increased effort by hospital staff to adhere to the Joint Commission standards and Department of Health regulations on medication management that have been put in place for patient protection. This shows that proper vigilance by emailing inspection reports and providing the suggestions for plans of action to all key stakeholders is effective; thereby, enhancing patient safety and regulatory compliance.

5-215

**Category:** Quality Assurance / Medication Safety

**Title:** Evaluating the impact of pharmacist led medication reconciliation on 30 day post discharge emergency department visits and hospital readmissions

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**Purpose:** The purpose of this project was to develop and implement a pharmacist led medication reconciliation service and evaluate its impact on 30 day post discharge emergency department visits and hospital readmissions. As many as 7.1% of hospital admissions are caused by adverse drug events and of these, 59% are believed to be preventable, many by adequate medication reconciliation.

**Methods:** This is a quasi-experimental study of a pharmacist developed, implemented, and led medication reconciliation service. A pharmacist was assigned to an internal medicine team for one month and took initial medication histories, confirmed home medications with retail or mail order pharmacies, and documented in the medical record. The pharmacist completed discharge medication reconciliation, reviewed discharge prescriptions for errors, made corrections, provided discharge counseling, and made a follow up phone call to patients within two weeks of discharge to answer medication related questions. All errors were corrected and documented in the medical record and on a data collection tool for additional analysis. A retrospective analysis of another internal medicine team which did not have a medication reconciliation pharmacist served as a control for the study. For both the intervention and control groups, medical records were reviewed at least 30 days following patient discharge. Both emergency department visits and readmissions were documented on a data collection tool, and data were evaluated. Readmissions for scheduled surgeries and procedures were excluded. This study was granted an exemption by the institutional review board prior to its commencement.

**Results:** Of the patients (n=17) followed by the medication reconciliation pharmacist from admit to discharge, one (5.9%) returned to the emergency department and two (11.8%) were readmitted within 30 days. Of patients (n=45) where the pharmacist completed admit medication reconciliation only, three (6.7%) returned to the emergency department and six (13.3%) were readmitted within 30 days. Of patients (n=89) who received standard, non-pharmacist led medication reconciliation, 28 (31.5%) returned to the emergency department and twelve (13.5%) were readmitted within 30 days.

**Conclusion:** Data indicate that pharmacist led medication reconciliation did not decrease 30 day hospital readmissions compared to the control. However, pharmacist led medication reconciliation did decrease 30 day emergency department visits compared to the control. The

feasibility of a hospital wide pharmacist led medication reconciliation service is still being evaluated at this time. This project was a pilot study to begin that process.

5-216

**Category:** Quality Assurance / Medication Safety

**Title:** Drilling down on hydromorphone and its global medication safety issues reports

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**Purpose:** In fall 2008, the hospital pharmacy hired an Assistant Director of Pharmacy dedicated to Medication Safety. Previously, the adverse drug reactions (ADR) were sparingly reported and documented in excel spreadsheet format. After being hired, she gradually increased the ADR reports. She review current trigger drugs list daily, and added numerous prospective and retrospective chart reviews. At the same time, she revamped the adverse drug reactions database from excel spreadsheet into a homegrown access database. In 2010, a robust data system was created and laid the groundwork in the paradigm of analytical data measures. In 2011, the Falls Committee Patients List was included for reviewing medication profiles. In December 2011, chart reviews from Code 99 patients list, of those patients requiring cardiopulmonary resuscitation became part of the retrospective chart review.

**Methods:** An intensive fourth quarter 2011 adverse drug reactions data aggregate analysis identified hydromorphone, a high alert drug, as a probable drug for causing harm to different patients. The Assistant Director, Informatics, ran reports of all hydromorphone formulations and doses administered to patients in the emergency department (ED), inpatients and the clinic treatment centers, from June through December 2011. Our institution, a medication management closed loop system by computerized physician order entry, pharmacists review and electronic nurses medication administration records (BCMA), enabled that all types of data could be retrieved. Both pharmacists collaborated together with a hospital hired statistician who ran those figures as statistics. Based on the findings, a new multi-disciplinary teamwork was created in early March 2012, to analyze and review data relating to the medication safety issues on hydromorphone.

**Results:** The multi-disciplinary teamwork consisted of the above three people in the initial analysis, ED physician, Sickle Cell Chief of Service, Pain Management Chief of Service, nurses from the sickle cell clinic, and the Associate Director of Nursing. The initial meeting shared and learned safety initiative. They reviewed the practices for assessment, and discussed the guidelines for pain, monitoring parameters and documentation. The second meeting took place in April 2012, to focus on the pattern of hydromorphone utilized in our institution and review the seven months 2011 internal data findings. The 2011, 7-months aggregate data results revealed 292 patients who were treated in the clinics, ED and inpatients, with a total of 9, 832 events that included administered dosages and routes. Overwhelming the intramuscular (IM) route of

97.96% was prescribed and administered. The frequency of the administered IM routes of all (about 98%) patients showed over 80% of the dosage was 4 mg or higher, with 49.48% administered at 6 mg doses. Patient Safety Organizations around the world recognize that hydromorphone is one of the leading medication that cause adverse drug events. The most prevalent adverse drug reactions are respiratory depression and sedation secondary contributing to falls. The types of patient population range from opioid-tolerant, opioid-naïve, and those who are in between those classifications. A report from the American Pain Society discourages intramuscular (IM) administration of pain medications. is painful, yields wide fluctuation in absorption, has up to a 60-minute lag time for analgesic effect, rapid fall off, any may cause sterile abscesses and fibrosis of muscle and soft tissue.

**Conclusion:** The dramatic internal data mining revealed shocked the institution to change hospital wide the predominately prescribed intramuscular routes. The Pharmacy Department recommends system enhancements. Revised pre-build CPOE order now shows subcutaneous route at the top, followed by IVP route then the oral route. Challenges still remain on the group working to find the best dosing regimen for various types of patient population.

5-217

**Category:** Quality Assurance / Medication Safety

**Title:** Implementation and evaluation of risk evaluation and mitigation strategies (REMS)

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**Purpose:** The U.S. Food and Drug Administration (FDA) has implemented several measures to identify and minimize adverse drug reactions associated with medications including the risk management action plans (RiskMAP) system in 2005 and the risk evaluation and mitigation strategy (REMS) in 2007. As defined by the FDA, a REMS must include a communication medium and may require the provision of a MedGuide. The Central Arkansas Veterans Healthcare System (CAVHS) started disseminating MedGuides in May 2010. Our objective was to assess patient understanding of the FDA-mandated MedGuides included in the Risk Evaluation and Mitigation Strategies (REMS) implemented at the Central Arkansas Veterans Healthcare System (CAVHS).

**Methods:** We chose the Oxycontin MedGuide for evaluation. We generated a weekly report of patients with new prescriptions for Oxycontin between February April 2012, and randomly selected ten patients each week to be contacted for a survey. Our goal was to complete 100 surveys within this timeframe. We contacted patients via telephone within 14 days of prescription issuance. If necessary, we mailed a MedGuide to the patient and re-contacted the patient within 7-14 days. A pharmacist administered the survey verbally. We scored the surveys to assess the patients understanding of the information contained in the MedGuide.

**Results:** We made initial contact with 100 patients, and completed 71 surveys. Seventy-six percent of the surveyed patients received a MedGuide with their prescription of Oxycontin. Fifty-five percent of the patients recalled being counseled by a pharmacist. The majority of patients (56 percent) reported reading all (100 percent) of the MedGuide, and 69 percent reported understanding all (100 percent) of the MedGuide. The average subjective knowledge score of 73.44 percent decreased with increasing age. We utilized Pearsons correlation coefficient to describe the relationship between the level of education and the subjective knowledge score. Correlations were also measured for the factors of education and perception, and perception and subjective knowledge score. All comparisons exhibited weak positive correlations with  $r = 0.099$ ,  $r = 0.081$ , and  $r = 0.138$ , respectively.

**Conclusion:** Patients subjective knowledge scores were similar to their perceptions. Most patients are reading at least some of the MedGuide provided to them. On average, patients are recalling about 73 percent of the information in the MedGuide. As education level increased, subjective knowledge score and patient perception appeared to increase; however, these were

considered weak positive correlations. The majority of patients had at least a high school or college education which was unexpected for this population.

5-218

**Category:** Quality Assurance / Medication Safety

**Title:** Preparation errors using an IV workflow manager at a pediatric hospital

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**Purpose:** Parenteral medication preparation is an essential component of pediatric hospital pharmacy. Preparation errors cannot always be detected with paper documentation unless a pharmacist is continuously present to observe production. In August 2010, Boston Children's Hospital implemented a pharmacy workflow manager for parenteral medication preparation. The objective of this analysis is to evaluate our experience with this system including identifying and classifying error types and error rates, especially those not previously present or detectable with our traditional paper documentation system which did not include continuous pharmacist observation except for designated high-risk medications.

**Methods:** Reports from the workflow manager system were used to identify all parenteral medication doses rejected or reworked by BCH pharmacists between January 8, 2011 and February 29, 2012. Pharmacists subsequently reviewed and classified these errors.

**Results:** During the 14 month analysis period, 425,683 parenteral medication doses were prepared through the workflow manager system. Of these doses, 422,871 doses (99.3%) were successfully verified without requiring rework or rejection. Preparation errors were identified during the pharmacist review for 1,650 doses (38.7 per 10,000 doses). Incomplete dose preparation documentation was found in 1,162 doses (27.3 per 10,000 doses). Of 1,223 doses requiring rework, 1,140 doses (93.2%) were corrected and dispensed, 66 doses were cancelled, and 17 doses were subsequently rejected. Of 1,677 rejected doses (including 17 doses initially reworked), 442 errors (26.5%) would not have been detectable with the paper documentation system.

**Conclusion:** With the implementation of the workflow manager system, pharmacists were able to identify both previously undetectable preparation errors and new documentation error types that were introduced by the system. Additionally, pharmacists were able to intercept potentially harmful errors that were previously undetectable with the paper documentation system. Further analysis is necessary to determine the clinical significance of implementing an IV workflow manager.

5-219

**Category:** Quality Assurance / Medication Safety

**Title:** Reengineering the patient home medication process from admission to discharge: a pharmacy and nursing collaborative

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**Purpose:** The collection of patients home medications at admission is a valuable part of the medication reconciliation process. Policies regarding the handling and management of patient home medications are institution specific. Standardized processing and delivery of patient home medications to the Department of Pharmacy was identified as an important collaborative project involving pharmacy and nursing leadership. At Johns Hopkins Bayview Medical Center, the responsibility for securing patient home medications is shared between these two departments. This project was designed to develop a standardized process for collection, documentation, storage, and retrieval of medications during a patients length of stay.

**Methods:** A taskforce consisting of nursing and pharmacy personnel was developed to identify the challenges with current practices related to patient home medications. Once admitted, patient home medications are collected and delivered to the pharmacy by nursing staff. These medications are then secured by pharmacy during the patient length of stay, and retrieved prior to patient discharge by nursing. The taskforce worked to develop an electronic discharge checklist in the Electronic Medical Record (EMR) that included medication retrieval from pharmacy. Over a 12 week study period, a pharmacy student audited and tracked the patient home medications on a weekly basis. Additional information gathered included the patient care units that were non-compliant with policy to determine the most common barriers to medication retrieval. Pharmacy personnel also submitted the data through the hospital patient safety reporting system.

**Results:** In the beginning of the study period, 80% of patient home medications secured by pharmacy belonged to discharged patients. Upon implementation of standardized practices, patient medications were audited on a weekly basis and the percentage belonging to discharged patients had been monitored. Over the 12 week study period, the number of unreturned medications significantly trended downwards to the target goal of less than 5%. The implementation of the electronic discharge checklist to include the patient home medications increased the timely retrieval of patient home medications.

**Conclusion:** The collaborative approach to standardize the patient home medication process has led to improved patient care and relations amongst pharmacy and nursing personnel. Implementing a multidisciplinary approach can lead to a more seamless discharge process,

ultimately improving patient satisfaction. Additional potential benefits for further study include saving the patient money by not having to re-purchase medications at discharge, decrease waste of home medications, and safer medication reconciliation.

5-220

**Category:** Quality Assurance / Medication Safety

**Title:** Engaging the staff pharmacist in the medication safety process

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**Purpose:** Pharmacists are considered medication experts and often make good catches of potential medication errors before they reach the patient. However, these good catches often go unreported or undocumented. Although there are multiple reasons for not reporting these potential medication errors, time constraints and patients care needs often limit the pharmacist from reporting them. Reported medication errors are discussed with staff to educate and prevent future errors. However, pharmacists continue to still learn about medication errors by word of mouth or rumors. The goal of this project is engage the staff pharmacist as medication safety experts by creating a centralized on-line repository to report any potential medication safety issue. This on-line site would act as a source of information and allows the pharmacist to make medication prevention suggestions.

**Methods:** Working with a team of Pharmacists along with a Pharmacy Informatics Specialist, a centralized repository, utilizing Microsoft SharePoint, was created. The site allows for quick reporting of potential medication errors, such as a look-alike sound-alike medication or an issue related to medication orderings. Potential medication errors are reviewed and entered into rI Solutions, the Health System's patient occurrence reporting program, as appropriate. The site has an additional benefit in that it allows staff to suggest prevention strategies and share information engaging staff in the medication safety process. Medication related news, alerts and internet sites, are posted to provide outside sources to learn about errors and potential problems. Suggestions are generated from both internal and external sources to enhance medication safety within our institution. Because of the security rights for SharePoint, the program has an additional functional acting as centralized location to share documents and files. The Medication Error Reporting and Improvement Team (MERIT) is a multidisciplinary committee comprised of Nursing, Patient Safety, Pharmacy and Informatics Specialists. The committee utilizes the site for sharing meeting agendas, topics, minutes and medication safety policy development. It allows for collaboration between members and disciplines providing a centralized repository for information. The site provides a useful tool to document safety related process improvement as it relates to the MERIT's activities. Joint Commission Medication Management Standard, MM 08.01.01, requires continual evaluation of the medication use process. The SharePoint website provides a place in to document assessments and risk point to the medication management system with the overall objective to improve medication use and patient safety.

**Results:** The Sharepoint has provided a centralized location to report potential medication safety issues and to document suggestions and prevention strategies. Pharmacists utilize the site and it

has improved reporting in the hospital online system by pharmacy. The site continues to improve pharmacy staff and MERIT members engagement in safe medication use.

**Conclusion:** The Medication Safety SharePoint has provided a centralized location to share safety medication information and prevention strategies with active staff participation. However, the site continues faces challenges and opportunities for improvement to meet the needs of the pharmacists and the committee members.

5-221

**Category:** Quality Assurance / Medication Safety

**Title:** Quality and staff satisfaction improvements with utilization of pharmacy technicians in the medication reconciliation process

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**Purpose:** A sound medication reconciliation process is the cornerstone for ensuring safe, appropriate medication administration for patients upon admission into the hospital setting. This project employed a novel workflow for our facility utilizing a dedicated pharmacy technician within the medication reconciliation workflow. The goal of the project was to increase the rate of complete and accurate medication reconciliation at admission and improve nursing, physician and pharmacist satisfaction and confidence in the accuracy of the process.

**Methods:** The established method for collection of the prior to admission medication list primarily involved nursing interview of patients regarding medications taken at home. This process relied heavily on patient recall or the availability of prescription bottles or lists as provided by the patient. Our project utilized a pharmacy technician with extensive outpatient pharmacy experience who received comprehensive training in assisting with the process of collecting a complete and accurate home medication list including electronically assessing outpatient prescription records. The technician would run outpatient prescription record queries for patients admitted through the emergency department. Outpatient records were used in combination with patient interview to determine the current home medication list. This medication list collected by the technician was then reviewed by a Clinical Pharmacist and validated by the patient's nurse. Rates of complete home medication records collected (drug name, dose, frequency, route, and prn indication) were compared at baseline and for patients in the pilot program. Surveys assessed baseline and post-study Nursing, Pharmacy and Medical staff satisfaction and confidence with the medication reconciliation process.

**Results:** Data was collected for 118 patients at baseline and 338 patients during the study period. Significant increases in the rates of complete medication lists were associated with the piloted process. Pharmacist and physician satisfaction and confidence in the accuracy of medication reconciliation were dramatically improved with the implementation of the technician assisted process.

**Conclusion:** Use of a dedicated pharmacy technician with access to outpatient prescription records to assist with collection of an accurate prior to admission medication list improved the rate of complete medication reconciliation and increased staff satisfaction and confidence in the accuracy of the process.

5-222

**Category:** Quality Assurance / Medication Safety

**Title:** Medication error reduction with barcode medication administration (BCMA) at a childrens hospital

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**Purpose:** Preventable errors are a target for improvement to decrease adverse events and patient harm. Adverse events related to medications occur at a rate of 6.5 per 100 inpatient admissions. Information technology advancements are being utilized to decrease medication errors. Closed-loop medication management improves the continuum of care by creating an environment that is electronic from order entry to point of care. Barcode medication administration (BCMA) and electronic medication administration records (eMAR) may decrease dispensing and administration errors. Reduction of medication errors reported has ranged from 56-96% with the implementation of BCMA in the adult population. There is less data in inpatient pediatric populations regarding implementation of computerized medication management. Errors in the pediatric population associated with medication administration have varied from 0.6% to 27%. The purpose of this study was to identify and quantify reported medication errors at the UCSF Benioff Childrens Hospital and project the number of errors that may be eliminated with the initiation of BCMA.

**Methods:** The institutional review board determined that this study is exempt as the use of the data were for improvement of institutional practice. Fiscal year 2011 was reviewed for pre-BCMA medication error rates at the UCSF Benioff Childrens Hospital. Data were comprised of all reported medication errors as categorized by incident reporting (IRs). Data collection included date, location, harm level, staff involved with error, and type of error. Neonatal ICU(ICN) and general pediatrics errors were divided as levels of care differed between groups. BCMA errors were further defined as errors that could be prevented by scanning the medication along with the patient identifier. BCMA linked eMAR errors were defined as errors that could be eliminated by eMAR prompting before drug administration.

**Results:** At the UCSF Benioff Childrens Hospital, there were 413 incident reports in the general pediatric population for fiscal year 2011. After the exclusion of medication dispensing overrides, there were 218 reported medication administration errors. There were 170 administration errors of which 74(21%) were BCMA and eMAR type errors. There were no reported life-threatening errors or patient deaths related to medication errors. The most commonly reported BCMA error was the wrong drug given to the wrong patient, 13/28 (46%). Although most of the occurrences did not harm the patient, errors could potentially occur with high risk medications leading to detrimental effects on patients. The most commonly reported eMAR error was wrong time administered to the patient, 24/46 (52%). This category comprised of forgotten doses, nurses

using the wrong stagger schedule, miscommunication during shift changes or demanding patient load which delayed medication administration. In the ICN, there were 48 reported medication errors, excluding medication dispensing override with 3 errors requiring minor procedural intervention or escalation of care. BCMA(8; 36%) or eMAR(14; 64%) type errors accounted for 46% (22/48) of reported medication errors. Error types were similar across all pediatric areas.

**Conclusion:** Although BCMA may not eliminate all medication errors, it could decrease the number of administration errors by 16%(28/170). With the addition of linked eMAR/BCMA, 44%(74/170) of medication administration errors may be eliminated, thus providing a safer environment for patients.

5-223

**Category:** Quality Assurance / Medication Safety

**Title:** Preventing Drug Shortages from Impacting Medication Safety

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**Purpose:** The Institute for Safe Medication Practices has reported safety issues related to drug shortages. Issues have arisen related to patient supply issues or the pedigree of the medications. Additionally, safety concerns have occurred due to the use of alternatives, different strengths, concentrations and dosage forms, and the ever changing appearance of the medication resulting in confusion for the nurse and the medical staff thus placing the patient at risk. Recognizing these risks, the pharmacy department needed to develop a timely, integrated approach. The goal of this project was to develop and implement effective communication strategies to alert all parties associated with patient care to potential drug shortage product issues.

**Methods:** The pharmacy has a weekly drug shortage meeting to review current shortages. The meeting is attended by Clinical Pharmacy Specialists, Operations Manager, Pharmacy Informatics Specialists, Coordinators, Pharmacy Safety Manager, Pharmacy buyer and Director of the Pharmacy Supply Chain. The meeting regularly addresses current stock levels, historical usage, potential alternative products and notification and modifications related to the hospital's Computerized Physician Order Entry (CPOE) clinical system. Potential solutions are generated and plans implemented. Recognizing the value of our current process, we added discussion related to the front line caregivers and the impact of product changes on patient care. The pharmacy has taken a proactive approach developing a plan to engage the nursing, medical and pharmacy staff in the drug shortage issue. The plan began with presentation to the Clinical Nursing Education Specialists and medical group. The presentation included potential reasons for shortages, frustrations associated with any shortages, costs, and how to find information about shortages. The pharmacy's on line formulary management tool which includes a section on Drug Shortages was utilized to update the nurses and medical staff of drug shortages in a timely fashion. The Clinical Nursing Education Specialists and medical staff were educated on how to use the program and where to find information about current shortages. Our CPOE system was updated with important drug shortage information at the point of order entry. Weekly updates summarizing the weeks shortage status was disseminated to the pharmacy, nursing and medical staff. In addition nursing was notified of significant changes in product appearance. Realizing, recognition is the first step in correct product selection, the pharmacy develops flyers to notify the nurses of the changes. Flyers include pictures of the current product and the new alternative. These posters are printed in color and posted in the medication rooms. The pharmacy continues to do on-going education with nursing staff expanding on the original presentation to include examples of potential issues related to the medication appearance.

**Results:** Utilizing medication error reports to gauge the impact drug shortages on medication safety the pharmacy monitors for trends. Prior to engaging our integrated process, errors due to drug shortages were on the increase. However, since implementing tools such as our CPOE

system, On-line formulary management tool, weekly memos and product postings of new products to the front-line nurses, pharmacy and medical staff, current medication errors associated with drug shortages have decreased to approximately 1% of all medication errors.

**Conclusion:** A successful program includes involves using different styles and techniques to communicate the information. Engaging the frontline nurse, the medical staff and pharmacy in the drug shortage issue has prevented medication errors. An integrated team approach reduced one persons burden (The Buyer) to an entire organizations focus, the lines of communication were opened between all patient care providers and errors as a result of drug shortages were reduced.

5-224

**Category:** Small and Rural Pharmacy Practice

**Title:** Rural hospital pharmacy services in Illinois: comparisons between critical access hospitals and small general community hospitals

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**Purpose:** Almost 67% of the 1,987 rural community hospitals in the U.S. are designated as critical access hospitals (CAHs). Qualifying criteria for CAHs are 25 or fewer inpatient beds, rural location greater than 35 miles from another hospital (or at least 15 miles from another acute-care facility in areas with mountainous terrain or only secondary roads), 24-hour emergency care, and an annual average length of stay not exceeding 96 hours. Relatively few research studies and/or descriptive innovations are published on pharmacy or medication-use systems in CAHs. The nature of CAHs merits exploration of the scope of pharmacy services offered in consideration of their rural location, small size and unique structure. As an initial step, the objective of this study was to describe pharmacy practices and technologies between CAHs and small, general community hospitals in rural Illinois settings.

**Methods:** This research was approved by the institutional review board at the University of Illinois at Chicago. A mail survey was administered to pharmacy directors at 86 small and rural hospitals in Illinois from November 2011 through February 2012. Hospitals were identified from a list of acute-care small and rural hospitals published by the Illinois Hospital Association, and the sampling frame included 51 critical access hospitals. Data were coded and entered into Microsoft Access and Excel files and analyzed using IBM SPSS Statistics 19. Independent t-tests and chi-square statistics (with residual analysis as appropriate) were used for comparisons between critical access hospitals and small general community hospitals. All results were expressed in terms of usable responses for each questionnaire item. The alpha value of 0.05 was used to determine statistical significance.

**Results:** The analytical sample included 23 (57.5%) CAHs and 17 (42.5%) rural general community hospitals (i.e., non-CAHs) for a response rate of 40/86 (46.5%). The CAHs had mean of 24.0 staffed beds compared with a mean of 93.4 beds for non-CAHs. The average daily census was 9.5 for CAHs and 60.1 for non-CAHs. The most common pharmacy practice model in respondent hospitals was a patient-centered model where nearly all pharmacists have distributive and clinical responsibilities, with no differences in the models of pharmacist deployment between CAHs and general rural hospitals ( $p=0.242$ ). When comparing drug policy tools used by

pharmacy to influence medication use within the hospital, two differences were identified. Specifically, all non-CAHs used automatic therapeutic interchange compared with 16 (69.6%) of CAHs ( $p=0.012$ ). A greater proportion of CAHs performed pharmacist-provided education programs for providers about medication costs ( $p=0.037$ ). No differences were found between CAHs and non-CAHs in the frequency of patient-specific clinical consultation services provided by pharmacy. The mean hours of inpatient pharmacy operation for CAHs were 58.4 hours per week, while non-CAHs were open an average of 111.1 hours. There was greater pharmacy utilization of off-site or remote medication order review or entry among CAHs ( $p=0.038$ ). Chi-square and residual analysis showed a higher than expected frequency of drug dispensing via the central pharmacy (rather than decentralized or hybrid drug dispensing systems) among CAHs ( $p=0.02$ ). A greater proportion of non-CAHs used automated dispensing cabinets than did CAHs ( $p=0.016$ ). Preparation of some sterile products was outsourced to off-site vendors more often by non-CAHs ( $n=12$ , 70.6%) than CAHs ( $n=7$ , 30.4%,  $p=0.012$ ). No differences were demonstrated between CAHs and non-CAHs ( $p$ -values  $> 0.05$ ) among any of the measured aspects of the medication administration and monitoring processes.

**Conclusion:** This study described pharmacy services for a sample of CAHs in comparison with other small rural community hospitals in Illinois to provide better context about challenges that may be faced in different rural settings. Results on differences for some pharmacy services should be interpreted in consideration of different patient mix, staff resources, and specialty services at CAHs and non-CAHs, as well as study limitations.

5-225

**Category:** Small and Rural Pharmacy Practice

**Title:** Increasing pertussis vaccination via an automatic vaccine assessment and administration tool

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**Purpose:** Pertussis (PT) incidence has steadily increased in the United States since the 1980s. Mortality is the highest in children 3 months of age or younger. Incidence of PT quadrupled from 2000 to 2005 and was highest among those younger than 6 months. Because the first PT vaccine is recommended for administration in children at 2 months of age in the US, vaccination of persons caring for or exposed to infants is recommended to decrease transmission and thereby incidence of PT in this at-risk age group. At our rural hospital, opportunities are available to address the vaccination status of patients and a mechanism for administering pneumococcal and influenza vaccines is available. However, no assessment tool or mechanism was available for the nurses to determine appropriateness and administer PT vaccine without a physician order. To increase compliance with the Centers for Disease Control and Prevention (CDC) recommendations, a tool was developed for nurses to assess a patient's eligibility for PT vaccination and to order vaccine. After education sessions, the tool was implemented for the maternity ward in July 2011. The overall objective of this study was to examine the impact of the tool on the rate of vaccination for PT among post-partum women.

**Methods:** This study was approved by the appropriate ethics committee or institutional review board and informed consent was waived. The number of doses of PT vaccine ordered and administered was recorded monthly from January 2010-October 2011. The number of doses ordered and billed was used as a surrogate marker for the number of doses administered to patients. A comparison of the pre-implementation period (January 2010-June 2011) was made to the post-implementation period (July-October 2011) and trends were noted. The number of admissions to maternity was also recorded per month and the number of doses per admission was calculated. Statistical analysis for homogeneity was done.

**Results:** In the pre-implementation period, there were 320 doses ordered in 18 months (18 doses/month). In the post-implementation period, there were 500 doses ordered in 4 months (125 doses/month). The number of doses per admission for the pre-implementation period was 0.05 and in the post-implementation period was 1. The number of doses billed and ordered were the same. Analysis indicated a significant increase in the number of doses ordered and billed in the two time periods.

**Conclusion:** The tool significantly increased the number of patients vaccinated for PT in our rural hospital in accordance with the CDC guidelines.

5-226

**Category:** Toxicology

**Title:** Management of carvedilol toxicity with intravenous fat emulsion: case report

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**Purpose:** This case describes the use of intravenous fat emulsion for management of carvedilol toxicity. Institutional review board reviewed this case report and determined that this does not constitute clinical research. As such, institutional review board review and approval of this as research is not required. An eighty five year old female presented to the hospital with weakness and lethargy and was found to have bradycardia with heart rate of 48 beats per minute (bpm) and blood pressure of 111/59 mmHg. She had a past medical history of heart failure, hypertension, hyperlipidemia, diabetes and depression. Medications at home were carvedilol, lisinopril, furosemide, glimepiride, bupropion, hydralazine, isosorbide dinitrate, and escitalopram. Electrocardiogram revealed sinus bradycardia with old left bundle branch block and patient was diagnosed with carvedilol toxicity. Patient was given two doses of atropine and glucagon without resolution of bradycardia. Then calcium gluconate followed by dopamine intravenous infusion was started. Patient heart rate improved with dopamine. However, systolic blood pressure of 200 mmHg necessitated decreasing the dopamine infusion rate and thinking of an alternative treatment modality. Intravenous 20% fat emulsion was given 1.25 ml/kg bolus followed by 0.25 ml/kg/minute for a total amount of 500 ml. Heart rate improved from 42 to 60 bpm with fat emulsion therapy. This effect persisted for several hours. Patient therapy was then limited per family wishes due to underlying comorbidity and patient expired. The use of fat emulsion therapy for management of lipophilic medication toxicity has been described for anesthetics, verapamil and propranolol. Carvedilol is a lipophilic beta blocker. This case demonstrated patient response to treatment of carvedilol toxicity with the use of fat emulsion therapy.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

5-227

**Category:** Transplant / Immunology

**Title:** Association of the CYP3A4\*1G polymorphism with the CYP3A5\*3 polymorphism and CYP3A5 mRNA levels in living-donor liver transplant patients, and its implications for tacrolimus dosage adjustment

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**Purpose:** Tacrolimus, which is used as a primary immunosuppressive agent in patients after liver transplantation, is mainly metabolized by cytochrome P450 (CYP) 3A4 and CYP3A5 in the liver and intestine. In clinical practice, it is difficult to adjust the optimal dose of tacrolimus because of its narrow therapeutic window and large inter-individual pharmacokinetic variation (Masuda and Inui, *Pharmacol Ther*, 112: 184–198, 2006). Recently, an intronic single-nucleotide polymorphism (SNP) in the CYP3A4 gene (CYP3A4\*1G) has been identified as a candidate explaining the large pharmacokinetic variation in metabolisms of fentanyl and midazolam (Yuan et al., *Clin Chim Acta*, 412: 755–760, 2011; Zhang et al., *Eur J Anaesthesiol*, 28: 245–250, 2011). In the present study, we examined the influence of the CYP3A4\*1G SNP on the mRNA expression levels of CYP3A4 and CYP3A5 in graft liver tissue and native intestine and the pharmacokinetics of tacrolimus in patients receiving living-donor liver transplantation (LDLT).

**Methods:** Between July 2004 and June 2011, 412 LDLT recipients and 414 donors at Kyoto University Hospital were enrolled after receiving their written informed consents. Two patients underwent retransplantation during this period. We carried out retrospective analyses of tacrolimus trough concentration/dose (C/D) ratio, CYP3A4\*1G and CYP3A5\*3 polymorphisms, and the mRNA expression levels of CYP3A4 and CYP3A5 in graft liver and native intestine. The blood concentration of tacrolimus was measured by microparticle enzyme-linked immunoassay between July 2004 and March 2009, or chemiluminescent immunoassay after

April 2009. The equivalence of the data obtained using these two methods was validated. The CYP3A4\*1G and CYP3A5\*3 polymorphisms were determined using TaqMan genotyping assays and PCR-restriction fragment length polymorphism analysis, respectively. The mRNA expression levels of CYP3A4 and CYP3A5 were quantified by real-time PCR. This study was conducted in accordance with the Declaration of Helsinki and its amendments, and was approved by Kyoto University Graduate School and Faculty of Medicine, Ethics Committee.

**Results:** The allele frequencies of CYP3A4\*1G and CYP3A5\*3 in graft livers were 0.215 and 0.786, and in native intestine were 0.242 and 0.769, respectively. The CYP3A5\*3/\*3 genotype was strongly linked with the CYP3A4\*1/\*1 genotype in both graft liver (93.6%) and native intestine (93.0%). The average expression levels of CYP3A5 mRNA with the genotypes CYP3A5\*1/\*1, \*1/\*3, and \*3/\*3 were 14.4, 9.36, and 2.09 amol/ $\mu$ g total RNA in graft liver and 1.75, 0.76, and 0.38 amol/ $\mu$ g total RNA in native intestine, respectively. There were statistically significant differences between \*1/\*1 or \*1/\*3 and \*3/\*3 in both graft liver and native intestine (P less than 0.001, Kruskal-Wallis test). The average expression levels of CYP3A4 mRNA with the genotypes CYP3A4\*1/\*1, \*1/\*1G, and \*1G/\*1G were 61.7, 63.7, and 71.0 amol/ $\mu$ g total RNA in graft liver and 5.90, 4.70, and 6.36 amol/ $\mu$ g total RNA in native intestine, respectively. These differences, however, were not statistically significant. The C/D ratio [(ng/mL)/(mg/kg/day)] of tacrolimus in the patients with a CYP3A5\*3/\*3 genotype in both graft liver and native intestine was significantly higher during the 7 days after surgery than those with CYP3A5\*1/\*1 and/or CYP3A5\*1/\*3 genotypes [median (range): 309 (28.9–1247) versus 147 (10.1–721); P less than 0.0001, Mann-Whitney U test]. Similarly, the influence of the CYP3A5\*3/\*3 genotype on the C/D ratio of tacrolimus was seen until 5 postoperative weeks. However, after the 8th postoperative day, no significant difference in the C/D ratio of tacrolimus between patients with CYP3A4\*1/\*1 and CYP3A4\*1G alleles (\*1/\*1G and \*1G/\*1G) was observed.

**Conclusion:** Compared to the CYP3A4\*1G polymorphism, the CYP3A5\*3 polymorphism had a greater influence on tacrolimus dose adjustment in patients after LDLT. Accordingly, determination of the CYP3A5\*3 SNP could be useful in individualized adjustment of tacrolimus dosage after liver transplantation.

5-228

**Category:** Transplant / Immunology

**Title:** Decreased Costs Associated With Transplant Medications By Focusing on Outpatient Administration

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**Purpose:** The increased use of marginal kidney donors and high-cost therapeutic antibody preparations have resulted in prolonged hospitalization and increased expenditures that have undermined the economic viability of kidney transplantation. The aim of this study was to determine if utilizing outpatient dosing of antithymocyte globulin (ATG) would result in equivalent clinical outcomes with significant cost savings.

**Methods:** This was a single center, prospective, observational before and after study of adult kidney transplant recipients who received ATG induction. Patients transplanted from 6/06 to 2/09 that received ATG served as the control group, and received standard dosing of ATG (1.5 mg/kg daily x5 doses). Patients transplanted between 3/09-8/10 and received ATG had the day of discharge dose delayed to the following day and administered in clinic

**Results:** A total of 231 patients (146 in the control group, 85 in the study group) were included. Baseline demographic analysis revealed similar patient characteristics between groups. Clinical outcomes were very similar between groups; biopsy proven acute rejection rates were low (5% in each group,  $p=0.707$ ). One-year patient (98% vs. 97%,  $p=0.502$ ) and graft survival rates (96% vs. 97%,  $p=0.365$ ) were excellent and also similar between groups. Infectious complications, including CMV syndrome or disease (14% vs. 7%,  $p=0.136$ ), and BK viremia (12% vs. 7%,  $p=0.363$ ) and nephropathy (9% vs. 4%,  $p=0.179$ ) were also comparable between the two groups. Economic analyses revealed that patients that had delayed ATG administration had a shorter length of stay in the hospital (3.9 vs. 3.1 days,  $p<0.001$ ), which translated to an estimated \$57,800 in savings due to decreased accommodation costs. Medication savings by delaying one ATG dose were \$73,101. Because this dose was given in the outpatient clinic the following day and could be charged outside the DRG, total increased revenue was \$157,760 for the intervention group. The overall total net margin improvement for the intervention ATG group compared to the standard ATG group was \$288,661 in the 85 study patients. After analysis of this data, we have expanded this program to include additional high-cost antibody preparations, including basiliximab, rituximab, and IVIG, with a focus on giving all appropriate doses in the outpatient

setting. Analysis of basiliximab therapy revealed that in 2010, 29.8% of all doses were given outpatient. With the implementation of this new program, in 2011, 43.4% of all doses were given in the outpatient setting, decreasing overall cost of the medication by over \$32,000.

**Conclusion:** Optimizing the logistics of antibody therapy by shifting utilization to the outpatient setting can significantly improve the financial disincentives of inpatient administration without compromising patient and graft outcomes

5-229

**Category:** Transplant / Immunology

**Title:** Hepatitis b virus prophylaxis cannot be discontinued after orthotopic liver transplant from a hepatitis b core antibody positive donor

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**Purpose:** Due to the scarcity of organs available for transplant, expanded criteria donors (ECD) are used in select liver transplant recipients to expand the donor pool. Donors that are hepatitis b core antibody (HBc-Ab) positive, suggesting current infection or previous exposure to hepatitis b virus (HBV), are considered as ECD donors for liver transplant recipients with hepatocellular carcinoma at our center. If the recipient is hepatitis b surface antibody (HBs-Ab) negative, they do not confer immunity to HBV. To prevent transmission and occurrence of acute HBV infection after liver transplantation in this scenario, lamivudine prophylaxis with or without hepatitis b immune globulin have been used successfully. However, the optimal duration of prophylactic therapy is unknown. We describe a 68 year old female transplanted for nonalcoholic steatohepatitis with concomitant hepatocellular carcinoma who was HBs-Ab negative at the time of transplant who received a liver from a HBc-Ab positive donor. The patient was given hepatitis b immune globulin and lamivudine prophylaxis post-transplant per institutional protocol. Six months after transplant, hepatitis b immune globulin was discontinued. Lamivudine monotherapy continued for 23 additional months and the patient remained HBs-Ab positive with negative quantitative HBV DNA titers throughout. At that time lamivudine was discontinued. Serial quantitative HBV DNA titers remained negative and HBs-Ab remained positive until 16 months later when 27 million HBV DNA copies were present and HBs-Ab was no longer detectable. There was an acute rise in liver aminotransferases at that time suggesting acute HBV infection. Lamivudine and tenofovir were initiated immediately and HBV DNA declined precipitously. Ten months later, HBV DNA copies decreased below 100 international units per milliliter but remain detectable one year after initiation of HBV treatment. We propose that HBV prophylactic therapy after liver transplant from HBc-Ab positive donors to HBs-Ab negative recipients cannot be safely discontinued even if patients spontaneously produce HBs-Ab.

**Methods:** N/A

**Results:** N/A

**Conclusion:** N/A

5-230

**Category:** Transplant / Immunology

**Title:** Effect of proton pump inhibitors on cyclosporin A levels after kidney transplantation in Lebanese patients

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**Purpose:** Cyclosporin A (CyA), a calcineurin inhibitor, has been used as the mainstay of immunosuppression in kidney transplant patients for decades. CyA has a narrow therapeutic index and is subject to high inter and intraindividual variability involving the absorption, distribution, metabolism and clearance phases. The coadministration of multiple drugs with CyA might change its circulating concentrations and result in higher risk of graft rejection and/or renal dysfunction. The purpose of this study was to investigate the potential drug interaction between CyA and proton-pump inhibitors (PPIs) in Lebanese patients undergoing kidney transplant.

**Methods:** The study is retrospective and was approved by the institutional review board. 37 kidney transplant patients (55 % men and 45% women) aged between 21 and 70 years old were enrolled. Patients received an initial CyA-based immunosuppressive regimen after their kidney transplantation and relevant data was collected at 2 weeks, 1 month, 2 months, 3 months, 6 months, 1 year, and 2 years. Monitoring parameters included CyA blood and intralymphocyte levels, lymphocyte count, side effects (oral lesions, gingival overgrowth, diarrhea, infections), other medications (antibiotics, antifungals, antivirals, acid suppressing agents) as well as graft function evaluation (ultrasound and biopsy) and other laboratory tests. CyA blood and intralymphocyte concentrations were compared at every time of follow-up between patients taking CyA alone or with a PPI.

**Results:** The combination of a PPI with CyA did not change CyA blood concentrations (1574149 ng/mL vs 1431186 ng/mL for patients taking CyA alone or with a PPI, respectively, after 3 months of treatment;  $p>0.05$ ). It showed to non-significantly increase CyA intralymphocyte levels (6613 pg/Lc vs 9426 pg/Lc for patients taking CyA alone or with a PPI, respectively, after 3 months of treatment;  $p>0.05$ ). Furthermore, the lymphocyte count was non-significantly decreased by the combination of a PPI to cyclosporin A (1741226 vs 1328129 for patients taking CyA alone or with a PPI, respectively, after 3 months of treatment;  $p>0.05$ ).

**Conclusion:** PPIs did not change the blood and intralymphocyte concentrations of CyA in our kidney transplant patient population. Further multi-point investigation on a higher number of patients on this or other potential drug interactions with CyA can contribute to prevent undesirable changes in its immunosuppressant effect.

5-231

**Category:** Transplant / Immunology

**Title:** 25(OH)-Vitamin D Level: An Indicator of Cirrhotic-related Complications & MELD Score

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**Purpose:** The model for end-stage liver disease (MELD) is used to prioritize cirrhotic patients awaiting liver transplantation; however, many indications for transplant are not reflected in MELD score. Vitamin D insufficiency is prevalent in liver dysfunction, but remains unknown whether 25(OH)-D levels are correlated with the degree of hepatic impairment and mortality.

**Methods:** Charts were reviewed for patients referred for evaluation for liver transplant from July 1, 2007 through June 30, 2011 regardless of recipient status. Once identified, patients were excluded for history of prior non-liver organ transplant, hemodialysis dependence at time of evaluation, an etiology of fulminant hepatic failure as primary diagnosis, or lack of at least one 25-OH vitamin D level drawn in the specified time period. To allow for variation in sampling, processing time, and labs obtained from external facilities, 25-OH vitamin D levels were included if time of collection was within 90 days of MELD labs. MELD score was determined using OPTN MELD calculator.

**Results:** Total 77 patient were identified. n= 7727% (n=11) of patients had a secondary etiology. 61% (n=25) and 24% (n=17) patients had vitamin D insufficiency and hyponatremia at the time of evaluation, respectively. To date, 85% (n=35) survived, 17% (n=7) received liver transplant and 15% (n=6) died some point after evaluation, one of which received OLT

**Conclusion:** 25-OH vitamin D insufficiency demonstrated a negative but weak correlation to MELD score. The strength of the association may be may become more robust if studied within a larger population. This study suggests 25-OH vitamin D may be a useful marker of liver disease severity. Identification of vitamin D deficiency could contribute to our understanding of liver disease severity aid in earlier referral and intervention for management in patients at risk for ESLD

5-232

**Category:** Transplant / Immunology

**Title:** Extreme temperature impact on tacrolimus oral suspension and serum levels

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**Purpose:** The purpose of this report is to describe a case of improper medication storage and its implication on a pediatric cardiac transplant patient. This case report was approved by the Nemours IRB. Controlled room temperature is defined by the U.S. Pharmacopeia (USP) as, "a temperature maintained thermostatically that encompasses the usual and customary working environment of 20 to 25 degrees Celsius (68 - 77 degrees Fahrenheit) that allows for brief deviations between 15 - 30 degrees Celsius (59 - 86 degrees Fahrenheit) that are experienced in pharmacies, hospitals, and warehouses." A 1 year old female patient underwent orthotopic heart transplantation in 4/2008 and was being treated post transplant with a 0.5 mg/mL tacrolimus compounded suspension as part of her immunosuppressive regimen. Her serum tacrolimus concentrations were stable and therapeutic, with the goal serum tacrolimus level of 7 to 10 ng/mL with small doses adjustments from 10/2008 to 7/2009 . At a routine clinic visit on 6/3/2009, she was considered to be stable from a tacrolimus immunosuppressant perspective based on a serum tacrolimus level of 8.8 ng/mL in conjunction with a cardiac biopsy from 2/2009 demonstrating no evidence of rejection. The patient was admitted 7/23/2009 for a routine 6 month cardiac catheterization with biopsy. The biopsy revealed grade 1R rejection and the patient had a corresponding a serum tacrolimus level of 4.8 ng/mL. The patient was admitted 7/30/2009 for repeat cardiac catheterization with biopsy following an increase in her tacrolimus dose gradually from 2 mg every 12 hours to 2.75 mg every 12 hours. The repeat cardiac biopsy confirmed grade 1R rejection and the corresponding serum tacrolimus level was 4.2 ng/mL. The transplant team opted to admit the patient for closer observation and management of the tacrolimus immunosuppression. During the hospitalization, the patient was resumed on the 2.75 mg every 12 hours dosing regimen. This dosing regimen resulted in a serum tacrolimus level of 14.2 ng/mL which was confirmed with a repeat level of 19.9 ng/mL. The patient was discharged following a dose reduction and stabilization in serum levels. A new bottle of tacrolimus suspension was provided to the patient at discharge. The new dosing regimen resulted in serum tacrolimus levels of 4.7 ng/mL on 8/5/2009 and 3.1 ng/mL on 8/12/2009 as an outpatient. The cardiac clinical pharmacist met with the parents and reviewed the medication administration schedule in addition to reviewing the recommended storage and handling procedures. An inspection of the outpatient prescription bottles was completed as was an assessment into the volume dispensed/volume used, whether the accurate dose volume was reflected on label, and that the medication was not beyond the expiration date. On 8/14/2009 it was discovered that the bottle was being stored in a non air conditioned room in the patients residence. A new bottle was supplied to the family and the dose was subsequently reduced. From this point forward, stable levels were maintained with subtle dose adjustments. The instability in the tacrolimus serum

concentration was thought to be a result of storing the tacrolimus oral suspension in excess temperature. The average high temperature at the Philadelphia International Airport in July 2009 was 85 degrees Fahrenheit with an estimated indoor non- air conditioned closed room temperature easily exceeding 100 degrees Fahrenheit. Extreme temperatures are thought to affect drug stability but the extent to which tacrolimus is affected is currently unknown. Further study is needed to evaluate tacrolimus stability at temperatures outside of controlled room temperature.

**Methods:** n/a

**Results:** n/a

**Conclusion:** n/a

5-233

**Category:** Transplant / Immunology

**Title:** Analysis of Serum 25-OH vitamin D levels and Association with MELD Score and Serum Sodium

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**Purpose:** The Model for End-Stage Liver Disease (MELD) is a prognostic index of mortality used to allocate organs to patients with the highest risk of death. MELD score is based on three analytical variables: bilirubin and serum creatinine and International Normalized Ratio (INR). Nevertheless, this model has some limitations and other metabolic parameters may be of interest. Vitamin D insufficiency and hyponatremia are common in end stage liver disease (ESLD) and studies suggest they may be associated with disease severity. Further understanding of the relationship of 25-OH vitamin D levels to severity of liver disease may eventually aid in earlier identification of ESLD. Therefore, we conducted a retrospective analysis to determine the relationship between serum 25-OH vitamin D and serum sodium levels in liver transplant candidates and their MELD scores.

**Methods:** Any patient referred to the outpatient transplant clinic from 2007 - 2011 at large academic medical institution identified in a retrospective longitudinal cohort of patients, through the prospective database. Patient with history of transplant, an etiology of fulminant hepatic failure, require renal replacement therapy, or received Vitamin D supplements were excluded. The MELD score will be calculated from three analytical variables: bilirubin and serum creatinine and International Normalized Ratio (INR) using OPTN calculator collected within 90 days of 25(OH)-D.

**Results:** As of now 77 patients are included in our retrospective study.

**Conclusion:** Our findings show a significant association of 25(OH)D with the degree of liver dysfunction and suggest that low 25(OH)D levels may predict hepatic decompensation and mortality in patients with chronic liver failure. Patients with a higher MELD scores, lower 25(OH)D and serum sodium levels at referral were at greater risk for death without transplantation, especially before listing. Evaluation of additional markers of liver disease, such as 25(OH)D may allow for earlier referral for transplantation candidacy and afford more timely organ allocation.

**Category:** Transplant / Immunology

**Title:** Cost effectiveness of belatacept-based regimen in kidney transplant recipients

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**Purpose:** Cardiovascular disease and allograft nephropathy are the leading causes of graft loss and death in kidney transplant recipients (KTR). The chronic use of calcineurin inhibitors in these patients has been associated with cardiovascular toxicity and nephrotoxicity. Belatacept, a biologic agent approved in June 2011, was proven non-inferior to the then standard of care in allograft and patient survival, and is associated with lower rates of cardiovascular and nephrotoxicities at an increased cost. The purpose of this study was to determine if the higher immediate cost of a belatacept-based regimen in KTR is justified by the overall decreased rate of cardiac and nephrotoxicity.

**Methods:** We conducted a health economic evaluation of the use of a belatacept-based regimen as compared with that of a tacrolimus-based regimen. The target population for the evaluation is low-to-moderate immunologic risk adult recipients of standard-donor kidneys without prior solid organ transplantation. Patients were assumed to be Epstein-Barr virus seropositive. The perspective we assumed for this evaluation is that of Medicare, as it is the major payer for a majority of kidney transplant programs. The setting of care is assumed to be outpatient, for week 2, 4, and every 4 weeks thereafter, for the intravenous administration of belatacept. Both regimens were assumed to have the same induction method and adjunct therapy post transplant. We created a Markov simulation using TreeAge 2012 software that was run for 3 cycles, with each cycle representing one year. The model assessed nephrotoxicity via progression to dialysis as a proxy for graft loss and acute rejection episodes. New onset diabetes after transplantation (NODAT) was used as a surrogate marker for cardiovascular risk with the assumption that the all cause death node would capture cardiovascular mortality. The primary endpoint was the cost per death averted of the adoption of the belatacept-based regimen. Historical cost data were adjusted to 2011 US dollars and future costs were discounted at a rate of 3%. A sensitivity analysis was performed using a Monte Carlo simulation, which was run for 10,000 trials. Variables associated with the decision nodes (e.g. NODAT, acute rejection) were triangularly distributed across a range of values that encompassed the best and worst case scenario for that particular node based on available data.

**Results:** The three year cumulative costs of the belatacept-based regimen were \$147,876 per patient with 954 patients surviving. The three year cumulative costs of the tacrolimus-based regimen were \$106,803 per patient with 870 patients surviving. Thus, the incremental cost-effectiveness ratio (ICER) was \$489 per death averted. The Monte Carlo simulation produced mean costs per patient for each regimen. The belatacept arm accrued a mean cost of \$180,274 per patient with 934 patients surviving. The tacrolimus arm accrued \$125,226 per patient with 883 patients surviving. Therefore the ICER for the Monte Carlo simulation was calculated to be \$1079 per death averted.

**Conclusion:** Based on this economic evaluation, the cost per death averted was found to be \$489. In comparison to the average high price of caring for a patient post transplant, this additional expenditure seems trivial. Differences in costs and outcomes will become clearer as new data from belatacept trials are produced.

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**Category:** Women's Health

**Title:** From Caring for Babies, to Delivering Them!

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**Purpose:** Pharmacists employed at tertiary childrens hospitals do not routinely deal with topics related to obstetrics and gynecology; therefore, with the addition of Texas Childrens Hospital Pavilion for Women, an extensive training program was developed to transition pediatric pharmacists into their new roles. This training program was required of all 26 pharmacists working at the Pavilion for Women, regardless of their previous employment background. The goal of this training was to evaluate the impact of a 20 hour didactic training module on pharmacists knowledge. Topics covered included: physiologic and pharmacokinetic changes, drugs commonly used, and various disease states encountered in the obstetric and gynecologic population.

**Methods:** Pharmacists were given 22 question pre-session and post-session surveys. Four questions on the pre-survey were related to how much preparation was completed prior to beginning the training sessions and how the pharmacists felt the training would impact their practice. One question focusing on the impact of the training was asked on the post-survey. The remaining questions focused on pharmacists self-rated knowledge of various OB/GYN topics. These questions used a 5 point Likert scale that ranged from 1 (no knowledge) to 5 (very knowledgeable). After the pre-survey was completed, pharmacists underwent two days of didactic training (totaling 20 hours) prior to administration of the post-survey.

**Results:** The average amount of time spent preparing for the training course was 75 minutes. When asked how useful the training sessions would be/was, 86.7% of pharmacists thought the training would be important to help them transition to caring for a new population of patient according to the pre-survey. This number increased to 96.7% on the post-survey (p-value <0.05). The mean self-rated knowledge rose from 2.86, across various OB/GYN topics on the pre-survey, to 4.2 (p-value < 0.05) on the post-survey. The three most notable differences in self-rated knowledge were in: maternal physiologic changes associated with pregnancy, medication use during lactation, and pharmacotherapy associated with critical care in OB patients.

**Conclusion:** Intensive didactic training provided meaningful increases in mean knowledge for pharmacist transitioning from pediatric to OB/GYN positions. This suggests that an intensive program geared toward providing education that transitioned pharmacists from one patient population to another is effective. Future research is now geared toward assessing whether or not

this knowledge then allowed for meaningful interventions on the part of the pharmacists that resulted in improved patient care.

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**Category:** Women's Health

**Title:** Effects of beta-2 adrenergic receptor polymorphisms on the delivery time in preterm labor treatment by ritodrine

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**Purpose:** Ritodrine is a widely used beta2-adrenergic agonist in patients with preterm labors because stimulation of beta-2 adrenergic receptor (ADRB2) results in uterine smooth muscle relaxation. However, beta2-agonist therapy has not been consistently successful at stopping preterm labor or prolonging pregnancy, possibly because of a wide inter-individual variability in therapeutic responses. This study aimed to evaluate the effects of ADRB2 polymorphisms on the efficacy and safety of the ritodrine in the treatment of preterm labor.

**Methods:** Sixty six patients diagnosed with preterm labor between 16 and 37 weeks gestation were enrolled in this study from January 2011 to October 2011. Patients were eligible for the study if they met the following criteria: preterm labor with intact membrane, gestational age of 20 to 37 weeks, 18 or older than 18 years of age, uterine contractions with a frequency of 3 per 10 min with cervical change, and provision of written informed consent. Exclusion criteria were congenital anomaly, rupture of membranes, major vaginal bleeding, severe pre-eclampsia, fetal/placental/amniotic abnormalities, fetal distress, and women whose continuation of pregnancy would be dangerous for them. The primary end point was the time (hours) from start of treatment to delivery. Secondary end point was the proportion of patients who remained undelivered at 24 hours, 48 hours, and 7 days. Five ADRB2 polymorphisms (rs1042713, rs1042714, rs1042717, rs1042718, rs1042719) were determined using sequencing or SNaPShot assay. The interval from start of treatment to delivery was analyzed with survival data analysis methods (log-rank test). Coxs proportional-hazards model was used for multivariate analysis for the primary end point. The chi-square test was used to compare the percentages of patients who remained undelivered at 24 hours, 48 hours, and 7 days. Logistic regression was used for multivariate analyses of the 3 end points. This prospective study was approved by the Ethics Committee of the Institutional Review Board. All patients gave written informed consent for participation.

**Results:** There were significant differences in the time from start of treatment to delivery between the CC and CA/AA genotypes in rs1042718 (median, 270.5 vs 401.5 hours, respectively;  $P < 0.05$ ). Patients with wild-type homozygotes of the MSRA gene (rs1042717)

resulted in an almost 2.5-fold longer time from start of treatment to delivery compared to those with heterozygotes or variant-type homozygotes (median, 464.8 vs 186.6 hours, respectively;  $P < 0.07$ ). The proportions of patients who remained undelivered were significantly higher in the GG genotype compared to the GA or AA genotypes in rs1042717 at 48-hour and 7-day end points ( $P < 0.05$  at both end points). From multivariate analysis, rs1042717 was found to be a significant factor of 7-day outcome after controlling other factors such as age, gestational age, and bishop score ( $P < 0.05$ ).

**Conclusion:** Differences in the time from start of treatment to delivery were attributable to the genetic polymorphisms of ADRB2 in subjects with preterm labors. The results of this study could give some preliminary data to predict efficacies and side effects of ritodrine for developing individualized treatment for patients with preterm labors.

5-237

**Category:** Women's Health

**Title:** The role of the community pharmacist in increasing awareness among oral contraceptive users in Lebanon

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**Purpose:** There are very rare awareness programs for contraception and contraceptives use available in Lebanon. The role of pharmacist for counseling about the indications, side effects, and missing pills management is very important to assure adequate use. The project was designed to evaluate the level of awareness among contraceptive users and to reveal the role of pharmacist in dispensing the oral contraceptives, providing adequate counseling and increasing the level of awareness in terms of indications, side effects, and missing a dose.

**Methods:** The survey was prospective in nature and done at two major community pharmacies and one out-patient department at a Lebanese hospital over three months where eighty one female, sixteen to fifty years of age, currently using oral contraceptives were included or voluntarily participated. A special questionnaire designed to reveal the effect of counseling was created and used: it included the main indications, most common side effects, and the missing dose adjustment to be assessed before and after the counseling session. A student T-test was used to calculate the differences in the measured outcomes.

**Results:** The effect of the counseling was clearly beneficial: out of six main indications for these hormones, the participants reported an increase of three in average, from two to five (CI 2.505-3.149,  $p < 0.0001$ ); nine more side effects out of fourteen are now recognized (CI 8.431-9.396,  $p < 0.0001$ ), and thirty three more females became aware of the measures to be taken in case of missing pill. Nonetheless, many interventions were done on the spot such as missed pills correction which was made to thirty three patients or the counseling for back up methods as the condoms to three more women, and only one patient was advised to switch to lower dose combined oral contraceptive after discussing with the physician since only one low dose combined oral contraceptive containing estrogen is available on the Lebanese market.

**Conclusion:** Most of the contraceptive users in Lebanon are unaware for combined oral contraceptives indications, most of the side effects precipitated by their use and thus resulting in a misunderstanding and wrong concerns about their health conditions. The results confirmed the essential role a pharmacist has as the drug counseling provider. We reported major improvements in overall contraceptive use and we highlighted special concern about how to deal with missing pills.

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**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Capturing pharmacy interventions without the use of external documentation software

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**Purpose:** Pharmacist interventions to ensure medication safety occur frequently in hospital inpatient settings. These interventions include medication selection and dosage recommendation, renal dosing, education and counseling prior to discharge to improve adherence, and pharmacists managed therapy. In addition, interventions done by pharmacists are often used to justify personnel and services and to document cost savings to the institution. Capturing interventions done by pharmacists typically involves them documenting their activities in external databases or software. As interventions are not part of the health record, it is often a challenge to verify all activities reported by pharmacists. It is also labor intensive to document activities in both the health records and in the interventions database and often many interventions never make it into the database. With the goal of improving capture rate of interventions and reduced workload on pharmacists related to documenting interventions, this project was designed to use the electronic health record (EHR) to directly identify pharmacy interventions without the use of an external intervention database/software.

**Methods:** Prior to January 2012, pharmacists were responsible for reporting their individual interventions in an external documentation software (Medkeeper). Starting in January 2012, interventions were pulled from the EHR on a monthly basis from pharmacy progress notes entered after rounding with physicians, therapeutic substitutions per P&T protocols, or interventions made as a result of telephone conversation with physicians. The pharmacists ceased using Medkeeper. The amount of time it took to put in interventions Medkeeper was determined by averaging the time self reported by pharmacists. The amount of time it took to extract interventions from EHR was determined by averaging the time self reported by pharmacists/pharmacist interns.

**Results:** The average intervention rate for 2011 was 676 interventions per month using external documentation software. Utilizing the new process (from January 2012 to May 2012), the intervention rates increased to greater than 3000 interventions per month. The interventions per 100 patient days improved from 30 to over 100. The average time commitment of entering interventions in the external software in 2011 was twenty hours total for the month when all the pharmacists times were combined. The average monthly time commitment for extracting interventions from EHR was five hours total with the new process.

**Conclusion:** Extracting interventions from pharmacy progress notes and order entry from electronic health records was more effective at capturing the full scope of pharmacists interventions and reduced the pharmacists time devoted to documenting interventions.

**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Formulary selection criteria for biosimilars: Considerations for health-system pharmacists

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**Purpose:** The Biologics Price Competition and Innovation (BPCI) Act of 2009, enacted in 2010, provides an approval pathway in the US for biosimilars (a biologic product that is highly similar to and has no clinically meaningful differences with the reference product, notwithstanding minor differences in clinically inactive components). Together with FDA guidances, the BPCI Act attempts to strike a balance between containing healthcare costs and protecting patient safety. However, questions regarding biosimilar pharmacovigilance, naming, substitution, and interchangeability remain to be addressed. This project was designed to help guide health-system pharmacists in developing evaluation criteria for biosimilars for formulary inclusion.

**Methods:** Biosimilar legislation, FDA guidance, peer-reviewed literature, available public data, and formulary decision-making practices were reviewed to identify key considerations and evaluation criteria for inclusion of biosimilars on formulary and determining clinical equivalence. A checklist that pharmacists could use in evaluating biosimilars was developed.

**Results:** Biologics are highly complex products manufactured using living cells and subject to subtle variations in structure resulting from numerous process-related factors (eg, growth, modifications, purification, and processing) that can potentially affect a products clinical profile. By their nature, and within the capabilities of present analytical science, biosimilars cannot have the exact same structure as the reference product. Consequently, biosimilars require more extensive evaluation compared with small-molecule generics. The evaluation of biosimilars for formulary inclusion should be done in a manner similar to the evaluation of any other biologic and principles of therapeutic equivalence should be followed. In addition to factors typically reviewed, pharmacists evaluating biosimilars should also request and understand manufacturer reliability and supply chain considerations. ASHP Guidelines for selecting pharmaceutical manufacturers and suppliers was published in 1991. However, there are few specifics included relating to biosimilar manufacturer-related evaluation parameters. More recently, an NCCN white paper on biosimilars has recommended that NCCN Guidelines Panels should evaluate recommendations regarding the use of biosimilars where available. Since health-system pharmacists will need to evaluate biosimilars based on a variety of parameters before adding them to a formulary, a supplemental checklist of publicly available data for consideration was developed and includes criteria for product evaluation as well as manufacturer-related

parameters such as drug availability, inventory turns, history of shortages, recalls, inventory levels, manufacturing redundancy, and supply chain security.

**Conclusion:** Ensuring a stable, reliable supply of quality product in a health-system is critical, particularly since biosimilars will not be substituted with the innovator product without being designated an interchangeable biosimilar. Under the BPCI Act, a biosimilar may be evaluated for interchangeability with the reference product, potentially allowing automatic substitution without the prescribers intervention, depending on state pharmacy laws. There is a separate and higher standard for FDA approval as an interchangeable biosimilar, therefore pharmacists should take this distinction into account. In addition to acquisition costs, health-system pharmacists will need to consider product and manufacturer information in their formulary decision making for biosimilars. A checklist addressing key product- and manufacturer-related information will promote thorough evaluation of biosimilars, permitting an educated decision regarding formulary inclusion.

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**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Developing a Residency Program through a Community-Based Research Project

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**Purpose:** To describe an innovative approach to support the development of a new Post-Graduate Year 1 (PGY-1) Residency Program.

**Methods:** The University of Mississippi School of Pharmacy (UM SOP) implemented a Community-Based Research Program in 2008. The first project which laid the foundation for the CBRP was the Delta Pharmacy Patient Care Management Project (Delta Project). The Delta Project focuses on the implementation of Medication Therapy Management services in community pharmacies, Federal and private provider clinics, and an employer-based setting in the underserved 18-county Mississippi Delta region. One goal of this project is to increase access to care. In addition to beginning new pharmacy services, the research team outlined a specific objective to increase the number of residency-trained providers for the community setting. In 2009, with financial support from this project and a partner community pharmacy, the UM SOP implemented a PGY-1 Community Pharmacy Residency Program CPRP.

**Results:** The CPRP was supported in the initial year through a regional organization with funding from Health Resources and Services Administration (HRSA) and accepted the first resident in July 2009. The CPRP is structured with longitudinal experiences in community pharmacy practice, patient-centered medical home, academics, research, practice management, and community-based research. This initial funding allowed for implementation of the program and demonstrated to School of Pharmacy administration the impact of a residency program in this underserved area. With these results, the School of Pharmacy approved an additional residency position in 2010, and the program received full accreditation for a six-year cycle in 2011.

**Conclusion:** Pharmacy may benefit from exploring innovative funding mechanisms for residency programs as the demand for additional residency positions increases. As grant opportunities arise, incorporating this objective into project proposals for education or research purposes may provide additional opportunities to expand residency positions.

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**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Communities of pharmacy: collaboration for safety, quality, and efficiency in a multi-hospital health system

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**Purpose:** Multi-hospital health systems are complex organizations with competing priorities, interests, and resources. However, objectives for quality, safety, and efficiency can be aligned to strengthen the system if hospitals collaborate. This collaboration can also be the catalyst for pharmacy practice model change as it can help manage complexity while capitalizing on knowledge and best practices. Pharmacy staff across our nine-hospital system have joined together to form Communities of Pharmacy to achieve mutually accepted goals to enhance practice and patient care.

**Methods:** Over time, multiple Communities of Pharmacy have been developed to address the various needs of the corporation. The major Communities of Pharmacy include the Directors of Pharmacy, Informatics, Clinical Pharmacy, Buyers, and Medication Safety. In addition to various subgroups for these major Communities, other, more specialized Communities have been formed as well, including Oncology, Investigational Pharmacy, and Anticoagulation. Although each functions somewhat independently, there is significant collaboration and several overarching objectives are consistent within the charters of each group: to improve safety and quality of patient care, to reduce costs, to increase efficiency of operations, and provide consistency and standardization.

**Results:** The Communities of Pharmacy concept has proven successful. Through the collaboration of the various groups, the impact of drug shortages has been reduced through early identification and inventory sharing. Collaboration has also led to the development and implementation of clinical practice guidelines, therapeutic interchanges, and a move towards a standardized formulary. It has also facilitated corporate contracting resulting in millions of dollars in cost savings. The Communities of Pharmacy have also been integral in the development of CPOE, providing guidance in both the clinical and operational arenas. There has also been a 10% reduction in nuisance alerts in the pharmacy information system through collaborative analysis and evaluation, as well as improvements made in clinical documentation. On a more basic level, the Communities have allowed for pharmacists at each hospital to capitalize on the knowledge and innovation seen at each of the other hospitals.

**Conclusion:** Communities of Pharmacy have evolved to effectively manage the many initiatives and challenges faced by a complex multi-hospital system. As our health-system moves towards CPOE, we have the opportunity to advance clinical practice through a coordinated effort to leverage our knowledge, technology and experiences through the Communities of Pharmacy. Best practices can be identified quickly, then embedded across the system to provide innovative and cost-effective patient care.

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**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Implementation of a unit-dose topical repackaging service in a tertiary care academic medical center

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**Purpose:** It is imperative that hospitals and health-systems control the costs needed to provide safe and effective care for patients. Pharmacy departments can help with controlling healthcare costs by identifying services that can be feasibly implemented, that provide a return on investment, and that improve the quality of care provided to patients. This study was designed to identify a service that would result in the outcome of a medication cost containment model within a tertiary care academic medical center.

**Methods:** This study consisted of three implementation phases, including a pre-implementation phase, a pilot phase, and a hospital-wide implementation phase. The pre-implementation phase consisted of identifying the unit-dose topical repackaging service, and setting-up the service for the inpatient pharmacy department to operate and sustain. The pilot phase consisted of running a small version of the service on select nursing units in order to obtain feedback regarding the service from healthcare professionals. Lastly, the hospital-wide implementation phase consisted of a full transition to the new service due to the success of the pilot phase.

**Results:** The pre-implementation phase of this study required members within supply chain management to evaluate medication-purchasing costs. This team decided that a unit-dose topical repackaging service would provide the pharmacy department significant cost savings. It took approximately eight weeks to set-up this service, which included creating new policies and procedures for the service in addition to purchasing new equipment, processing supplies and bulk product to create the unit-dose product. The pilot phase of this study involved testing the unit-dose product on two nursing units over the course of four weeks. The nursing staff was able to confirm the projected outcome that the new product would be easier to administer to patients. Due to the success of the pilot phase, the hospital-wide implementation phase took only one day to complete.

**Conclusion:** The implementation of a unit-dose topical repackaging service slightly increased the workflow for the inpatient pharmacy, decreased nursing preparation and administration times, and increased cost savings associated with dispensing the unit-dose product. Based on the long-term results of this service, there is a potential for adding additional agents to the repackaging service.

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**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Cost benefit analysis of a universal needleless adaptor system for reconstitution and transfer of sterile medications in two hospital settings

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**Purpose:** With increasing medication shortages, medication management is a key aspect for pharmacy departments across the country. By utilizing a unique needleless adaptor system that allows standard drug vial adaption to any standard intravenous container, hospitals can maintain an inventory of only one brand of intravenous fluid product line. This allows hospitals to provide ready-to-use dosage forms 24 hours every day to patients and nursing staff. In addition, vial reconstitution and transfer to intravenous fluids can occur shortly before administration minimizing medication waste, product expiration, sterile preparation labor costs, and delay in medication administration.

**Methods:** Pharmacists completed a retrospective cost benefit analysis of implementing a unique needleless adaptor system at both a 550 bed tertiary medical center emergency department and a 25 bed regional hospital. The primary objective of this cost benefit analysis was to evaluate the cost of supplies needed to compound intravenous products and medication costs over a 12 month utilization period.

**Results:** Over a 12 month utilization period, the tertiary medical centers emergency department saved \$634.15 (decrease in product expiration and overall product cost) and the regional hospital had a \$19,576.54 decrease in cost (decrease in medication cost and overall product cost).

**Conclusion:** A unique needleless adaptor system for ready-to-use dosage forms decreases product expirations, medication costs, and overall product costs. The system also allows the pharmacy departments to better control inventory and medication costs with increasing medication shortages.

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**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Economic impact of a dexmedetomidine order set in a community hospital

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**Purpose:** A 201-bed, not-for-profit community hospital experienced a significant increase in the use of dexmedetomidine. The purpose of this project was to develop an order set and measure the financial impact of the implementation of the order set, including usage of pain and anxiety medications.

**Methods:** Based upon purchase data, evaluate the usage of dexmedetomidine, pain medications, and anxiety medications before and after development and implementation of a pre-printed order set.

**Results:** Purchase data identified a 169% increase in dexmedetomidine spend comparing the nine months ending October 2010 and July 2011, \$30,272 and \$81,400 respectively. A pre-printed order set was approved by the Pharmacy and Therapeutics Committee and implemented in August 2011. Purchases were compared for the nine months prior to implementation of the order set to the nine months after implementation. Decreases in dexmedetomidine spend, ICU days, and dexmedetomidine spend/ICU day were found. Dexmedetomidine purchases decreased from \$81,400 to \$54,864 (- 32.6%). ICU patient days decreased 3,489 to 3,155 (- 9.6%). Dexmedetomidine spend per ICU patient day decreased from \$23.33 to \$17.39 (- 25%). Anxiety and pain medication spend increased from \$56,387 to \$59,425 (5.4%) or \$16.16 to \$18.84 per ICU patient day (17%). One of the limitations was a reduction in ICU patient days during this time period which contributed to the reduction in drug spend.

**Conclusion:** The implementation of a dexmedetomidine pre-printed order set resulted in savings. Hospitals using dexmedetomidine without guidelines/order set should consider this initiative.

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**Category:** Administrative practice / Financial Management / Human Resources

**Title:** Economic impact of a therapeutic interchange for parenteral iron in a community hospital

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**Purpose:** With the availability of a generic formulation of sodium ferric gluconate complex in sucrose injection and favorable pricing, a 201-bed, not-for-profit community hospital evaluated parenteral iron formulations. The purpose of this project was to review usage and standardize to one formulation with the implementation of a therapeutic interchange.

**Methods:** Review cost and purchase data for iron parenteral formulations and develop a therapeutic interchange protocol to utilize one preferred agent.

**Results:** Purchase data identified that four different branded products (iron sucrose complex, sodium ferric gluconate complex, and iron dextran complex) were being purchased. Purchases of all parenteral iron preparations for 10 months prior to the interchange were \$21,636. The interchange to generic sodium ferric gluconate complex was approved by the Pharmacy and Therapeutics Committee and implemented in July 2011. For the 10 months after implementation, purchases of parenteral iron were \$2,106, representing a 90.27% reduction in drug spend. One of the limitations is that there was a reduction in patient days during this time period which contributed to the reduction in drug spend; however, patient days decreased by only 9.5%. When evaluating cost per adjusted patient day (APD), drug spend decreased from \$0.47 per APD to \$0.05 per APD (89% reduction). The economic impact of the interchange does not include the additional benefits of the sodium ferric gluconate complex chosen (e.g., elimination of a filter needle, faster preparation time, and improved stability contributing to less waste).

**Conclusion:** The implementation of a therapeutic interchange for parenteral iron preparations to the generic sodium ferric gluconate complex formulation resulted in a significant savings. Other hospitals using multiple parenteral iron products should evaluate this opportunity.

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**Category:** Infectious Diseases

**Title:** Improving outcome measures through the implementation of an antibiotic stewardship program at a community based hospital

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**Purpose:** In December 2010, Baptist Hospital initiated an antibiotic stewardship program in efforts to improve the quality of patient care as it relates to antimicrobial therapy. The antibiotic stewardship team consists of two infectious disease pharmacists and two infectious disease physicians who provide guidance regarding antimicrobial utilization within the hospital. The objective of this project is to evaluate outcome measures impacted by the program.

**Methods:** The antibiotic stewardship program consists of concurrent reviews conducted by the infectious disease pharmacists. Examples of recommendations include discontinuing therapy where no infective source is found, de-escalating from broad spectrum to narrow spectrum antimicrobials, switching from parenteral to oral therapy, dose optimizing, and preventing drug interactions. If an intervention is indicated, the physician is contacted directly with recommendations or a communication note is left on the chart for physician review. Data was evaluated one year before and after implementation of the program. The outcome measures evaluated include average targeted antimicrobial use (expressed as defined daily doses [DDD] per 1000 patient-days), total antimicrobial expenditure, average Hospital-Associated Clostridium difficile infection rates per 10,000 patient-days, and changes in antimicrobial susceptibility patterns.

**Results:** Targeted antimicrobials included selected anti-pseudomonal antibiotics and ertapenem. DDD per 1000 patient-days per year averages were decreased after implementation of the program compared to 1 year prior with the exception of cefepime which remained stable (aztreonam 5.2 to 4.3, cefepime 41.4 to 41.5, ceftazidime 13.9 to 11.1, piperacillin/tazobactam 43.8 to 38.1, anti-pseudomonal carbapenems 23.5 to 15, ertapenem 25.6 to 20.7). Total antimicrobial expenditure decreased from \$749,762 in 2010 to \$609,886 in 2011. The average Hospital-Associated Clostridium difficile infection rates per 10,000 patient-days declined from 7.4 in 2010 to 4.9 in 2011. From 2009 to the most current antibiogram there were several notable changes in susceptibility patterns. E.coli sensitivity to fluoroquinolones increased by 5% in systemic isolates, P. aeruginosa sensitivity to cefepime increased by 3% in systemic isolates and by 6% in urine isolates, and MRSA rates decreased by 4% systemic isolates and by 5% in urine isolates.

**Conclusion:** The successful implementation of our antimicrobial stewardship program strategies had a significant impact on antimicrobial utilization. Several areas of improvement were identified, including overall decreased utilization of anti-pseudomonal antibiotics and ertapenem, decreased overall antibiotic cost, decreased average Hospital-Associated Clostridium difficile rates, and positive changes in susceptibility patterns and MRSA rates.

