

ASHP 2013 Midyear Clinical Meeting

Professional Poster Abstract

3-001

Category: Administrative practice / Financial Management / Human Resources

Title: Financial impact of pharmacy and therapeutics committee on an acute-inpatient rehabilitation hospital bottom-line

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Purpose: The pharmacy operating costs makes up a significant portion of the hospital total budget. And in light of reimbursement cuts from Medicare and Medicaid, hospital administrators continually seek ways to improve efficiency and control costs without affecting optimal patient-care. Although pharmacy is a major cost center in most hospitals, it plays a critical role in patient safety and clinical-outcomes which is central to healthcare-reform reimbursement act. The purpose of this write up is to estimate the financial impact of the pharmacy and therapeutics committee (P&T) on drug formulary and ultimately the bottom-line of an in-patient rehabilitation hospital. The P&T consists of multidisciplinary clinicians working closely together to improve patient care and reduce drug costs. Needless to state other non-quantifiable P&T activities such as cost of prudent formulary management optimized clinical efficacy etc.

Methods: The P&T committee endeavors in our rehabilitation hospital were focused on therapeutic drug classes that constitute 20% of pharmacy inventory but accounted for 80% of total drug costs. The drugs that accounted for pharmacy top dollar expense were anticoagulants (enoxaparin, fondaparinux, dalteparin), antibiotics (imipenem/Cilastatin, linezolid, tigecycline, daptomycin), erythropoiesis stimulating agents (ESAs) darbepoetin, epoetin alfa, iron products (iron sucrose, dextran, sodium ferric gluconate), insulin (glargine, detemir), respiratory meds (fluticasone/salmeterol, tiotropium, levalbuterol), topical agents (lidocaine patch, collagenase), and central nervous system (CNS) stimulants (modafinil). Formulary deletion and restrictions as well as therapeutic interchanges (TI) were implemented and enforced for these drug classes over a 3 year period; 2010, 2011, and 2012. The cost savings for each year was calculated and compared to years prior to TI.

Results: In 2010, the cost savings were attributed primarily to anticoagulants and insulin TI; in 2011 to CNS stimulants and antibiotics; and in 2012 to ESAs. The total estimated direct drug expense (DE) savings achieved due to P&T formulary streamlining were \$175,000, \$147,000,

and \$45,000 in 2010, 2011, and 2012 respectively. This represents about 21%, 19%, and 6% of the total DE in 2010, 2011, and 2012 respectively. Consequently, the pharmacy DE ratio to total pharmacy operating expenses (OE) during those years declined accordingly to 45%, 40%, and 37%. This was a significant reduction compared to previous years when DE to OE ratio was over 50%. Historically, the pharmacy OE takes up about 4% of our hospital budget however a steady decline has been noted since new P&T initiatives in 2010 (3.11%), 2011 (3.08%), and 2012 (2.93%). These cost savings were primarily due to the new P&T initiatives; however the cumulative dollar amount over the years could not be computed.

Conclusion: In the era of value-based reimbursement and accountable-care models, increasing healthcare and drug costs, cost-containment strategies and specifically drug cost-control through P&T committee initiatives can have positive impact on the bottom-line of an inpatient rehabilitation hospital.

3-002

Category: Administrative practice / Financial Management / Human Resources

Title: A model for developing a hospital pharmacy collaborative drug therapy management agreement

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Purpose: Collaborative drug therapy management (CDTM) agreements exist between pharmacists and physicians in order to allow pharmacists to legally manage medication therapy under a defined protocol. CDTM agreements have been shown to improve patient outcomes. This report describes the process used to form a vancomycin collaborative practice agreement in a large tertiary care, teaching hospital amongst the pharmacy department and all medical providers.

Methods: A workgroup was established to develop a model for creating and implementing CDTM agreements using a vancomycin CDTM agreement as its prototype. Members of the workgroup to develop this collaborative practice agreement were carefully considered. A chair of the committee with particular interest in the collaborative practice agreement and an interest in leading the group was identified. One member from each pharmacy team in the department was then selected. Pharmacy administrators were represented on the committee to ensure administrative and resource support. The total committee size was 8 pharmacist members. Upon meeting, ground rules were established and a roadmap for developing the CDTM agreement was made. Roles and responsibilities on the committee were clearly defined. After these steps were completed, clinical decisions, standard operating procedures, and support tools were developed. The CDTM agreement model favored an evidence-based approach with literature reviews and in-depth discussions and clinical debates conducted as needed.

Results: A vancomycin CDTM agreement was successfully implemented at our center employing 75 pharmacists. Throughout the CDTM agreement development process, the pharmacy department was regularly updated at staff and team meetings regarding the status of the project prior to formal education with an emphasis on transparency. Six months elapsed between the initial meeting and the first of three formal departmental teaching sessions. Pharmacists were taught vancomycin pharmacokinetics and pharmacodynamics, in addition to standard operating procedure expectations, such as documentation standards within the electronic medical record. Prerequisite work was required prior to these sessions that prepared pharmacists for the continuing education session and live case discussion. A written competency assessment was administered after the training session that paralleled the prerequisite work and continuing education module. This CDTM agreement training process yielded a pass rate of

95%. All pharmacists who did not pass successfully completed one-on-one training. A seamless hospital implementation occurred 3 weeks after the final training session. Continuous quality improvement and CDTM agreement process adherence was implemented and will continue as long as the CDTM agreement is in place.

Conclusion: CDTM agreements are becoming more common in the hospital pharmacy setting. Clearly defining processes and ensuring competency with the agreement and standard operating procedures is imperative. This project was successful due to the diverse committee that represented views of end-users across the hospital. Administrative support on the committee ensured navigation of the required processes for hospital implementation and departmental support. Future directions include a systematic implementation of this vancomycin CDTM agreement at all other facilities in the health system. In addition, it serves as a model for all future CDTM agreements.

3-003

Category: Administrative practice / Financial Management / Human Resources

Title: Factors that could drive use of utilization controls for drugs used in an inpatient peri-operative setting

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Purpose: Advanced technologies to control hemostasis in peri-operative microvascular/coagulopathic bleeding are undergoing clinical development. The adoption of access and utilization controls by US hospitals based on product factors like label content, indication breadth, cost, and other attributes was not found clearly articulated in the published literature. The aim of this project was to create an understanding of the potential for various product attributes to cause a need for developing access and utilization control measures.

Methods: A descriptive, on-line survey was administered to general and specialty surgeons, anesthesiologists, and clinical pharmacists. Respondents had to work in teaching or academic institutions of at least 200 beds that performed complex cardiac surgery. They also had to be familiar with pharmacy utilization control measures for medications used in adult in-patient peri-operative settings. Survey items clustered around the following areas of inquiry: Mechanisms to Control Utilization; Information in Package Insert Used to Control Utilization; Utilization Restrictions on Selected Analogues; Restriction of Agents Indicated for Microvascular/Coagulopathic Bleeding; Influence of DRG Payment on Utilization Controls; Who Sets and Influences Utilization Control Measures for Hemostatic Agents; and, Additional Insights from Survey Respondents. Factors that might determine whether access to or utilization of inpatient medication is controlled were clustered around economic, misuse/overuse, payment, evidence and package insert (PI) related variables. The hospital setting (general, peri-operative, complex cardiac surgeries) was varied for the determinant questions to see if factors and their importance varied by setting. Five analogues with broad indications (RECOTHROM, EVICEL, EVITHROM, VOLUVEN, and TRASYLOL) were used to probe about utilization controls for hemostatic agents.

Results: There were 22 respondents overall: 8 surgeons (3 cardiac, 4 orthopedic, 1 general), 6 anesthesiologists and 8 clinical pharmacists. Economic-related variables (i.e., acquisition cost, budget impact, fully loaded cost) were most frequently chosen as factors that typically determine whether access to, or utilization of, an inpatient medication is controlled followed closely by evidence-related variables (i.e., published efficacy studies, consensus guidelines). Variables within domains of economic-related and evidence-related were ranked as the three most important factors influencing utilization controls. Only 9 respondents (41%) selected information in a product's label-package insert as a determinant of access/utilization controls in a general

hospital setting: fewer in a peri-operative setting (n=4) and for complex cardiac surgeries (n=6). Restriction frequencies to pre-defined analogues were as follows: RECOTHROM 53%, EVICEL 53%, EVITHROM 57%, VOLUVEN 47% and TRASYLOL 36% (prior to removal from the market in 2007). The majority of respondents (n=15, 68%) thought DRG payment influenced adoption of utilization control mechanisms for new hemostatic agents in one or more of the specified surgery categories (cardiac, thoracic, intra-abdominal, orthopedic, hepatic transplantation, trauma, neurosurgery, or OB-GYN). Respondents indicated that P&T Committees and then surgeons typically set and influence medication utilization controls for hemostatic agents in an in-patient peri-operative setting.

Conclusion: The survey results from a small number of respondents suggested that product cost, limited evidence of clinical effect, and safety as being the biggest drivers of product use restrictions. Although a broad label was not identified as a major attribute of concern per se, some respondents preferred strength of evidence consistent with broad indication labels as preferred to products supported by results from smaller individual studies. The research suggests that the product utilization and access limitations are minimized when new products are considered to have a good balance of unmet need, clinical safety and efficacy, and price.

3-004

Title: Criteria for success: correlations within a pharmacy post-graduate year 1 (PGY1) residency selection process at a community health-system

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Purpose: The PGY1 residency selection process has become increasingly competitive given the growing number of applicants every year and the introduction of Pharmacy Online Residency Centralized Application Service (PhORCAS). Thus, it has become more challenging to identify the most qualified candidates for the interview process. Students often ponder what qualities would make them an outstanding PGY1 candidate. Studies to date have pertained mostly to medical school residency, but this study aims to determine which individual characteristics are associated with a candidates success when applying and interviewing for pharmacy residency programs. Comparisons between the selection criteria and interview performance will be assessed.

Methods: In this ambidirectional cohort study, 50 PGY1 candidates who applied to our institution were followed. Selection criteria, which included Curriculum Vitae (CV), Grade Point Average (GPA), and Letter of Intent (LOI) scores, were compared between the interviewed and non-interviewed applicants. The interviewed candidates CV and LOI scores were compared with their panel and pharmacy director interview scores, while GPA was compared with their written score on a clinical case. Finally, interviewed candidates obtained an overall score which was based on the selection criteria, interview performance and written scores. A comparison was made to see whether the interviewed candidates were selected into other residency programs and whether the selection criteria between our institution and others were comparable. Statistical analyses were completed using STATA software with an alpha value of 0.05.

Results: Of the 50 PGY1 candidates reviewed, 39 were offered an interview. Interviewed candidates had significantly higher mean CV scores (1-sided $P = 0.016$), higher mean LOI scores (1-sided $P = 0.010$) and higher mean GPA scores (1-sided $P = 0.005$) than candidates who were not interviewed. Comparison of characteristics between interviewed candidates revealed that CV scores are positively correlated with panel ($R = 0.31$, $P = 0.05$) and director ($R = 0.39$, $P = 0.013$) interview scores; however, no significant correlation was seen between LOI and panel ($R = 0.19$, $P = 0.24$) or director ($R = 0.23$, $P = 0.15$) interview scores. No correlation was observed between GPA and written score ($R = 0.04$, $P = 0.83$) among the interviewed candidates. Finally, the overall score of the 34 interviewed candidates (5 candidates were lost to follow-up) was compared to their selection into residency programs. Candidates who were matched into residency programs had a significantly higher overall score (1-sided $P = 0.0005$) and higher LOI

score (1-sided $P = 0.001$) than candidates who did not match. There were no significant differences between the two groups for CV score ($P = 0.12$) and GPA score ($P = 0.21$).

Conclusion: While CV, LOI, and GPA are all good influencers in obtaining an interview, CV and GPA scores may not be predictors of whether an applicant matches. LOI may not correlate to interview performance and GPA may not correlate with written clinical performance, but CV scores may predict better interview performance. While this study sheds light to how certain scores may correlate to interview selection and eventually match success, further studies are required to validate these findings with other institutions.

3-005

Category: Administrative practice / Financial Management / Human Resources

Title: Considerations in developing oral chemotherapy safe practice policies and procedures in the health-system setting

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Purpose: The administration of chemotherapy has traditionally been via the intravenous route, but the landscape of therapy has significantly changed due to the advent of oral agents and their numerous advantages, including enhanced quality of life, improved patient convenience, and reduced healthcare expenses. Unfortunately these benefits are not without risks, as oral chemotherapy possesses comparable toxicity as traditional chemotherapy, and should be handled following the same stringent procedures. Currently there are no comprehensive oral chemotherapy guidelines available to guide clinical practice, therefore we designed this project to highlight key considerations in developing institutional policies and procedures to guide the safe dispensing and administration of oral chemotherapy.

Methods: The American Society of Clinical Oncology(ASCO)/ Oncology Nursing Society (ONS) Chemotherapy Administration Safety Standards; Clinical Oncological Society of Australia (COSA) Guidelines for the Safe Prescribing, Dispensing and Administration of Cancer Chemotherapy; Society of Hospital Pharmacists of Australia (SHPA) Standards of Practice for the Provision of Oral Chemotherapy; peer-reviewed literature; available public data, and current clinical practices were reviewed to identify key considerations in developing oral chemotherapy policies and procedures.

Results: Healthcare providers are tasked with a large responsibility when providing oral chemotherapy, therefore it is important to establish standardized education for current and new healthcare providers that includes written and observational competency assessments. Prior to dispensing an oral chemotherapy prescription, a pharmacist with oncology experience should verify the medication order, ensure patients readiness for self-administration, evaluate dose appropriateness, and perform medication reconciliation. A second check should always be performed by another pharmacist, nurse, or physician with equivalent oncology training. For inpatient dispensing, the quantity should not exceed a 24-hour supply and should be dispensed in unit-dose containers. Storage and labeling are also essential elements of an oral chemotherapy policy. Institutions should limit the number of dosage forms and concentrations available to minimize dispensing errors, and all oral chemotherapy agents should be stored in a designated cytotoxic area. A cytotoxic label should be affixed to all oral chemotherapy agents so that they are easily identifiable by all staff members. Institutions should develop medication-specific patient education materials and provide both written and oral instructions to patients and

caregivers outlining administration, storage, handling, disposal, side effects, and missed dose management.

Conclusion: In the past decade, over 11 new oral chemotherapy agents received FDA approval, and this number is expected to grow as 25-30% of new cancer medications in development are designated to be oral agents. It is important for institutions to develop policies and procedures to ensure the safe dispensing and administration of oral chemotherapy.

3-006

Category: Administrative practice / Financial Management / Human Resources

Title: Economic impact of supply chain management initiatives in an academic medical center

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Purpose: Hospital pharmacy departments are challenged with meeting drug cost containment goals and improving inventory control. Many healthcare organizations are facing mandatory budgets cuts to meet hospital financial goals. In addition, prioritizing goals, increasing staff accountability and being able to measure the economic impact, while meeting patient care needs, are of constant concern to pharmacy leadership. Supply chain management initiatives were designed and prioritized to assist pharmacy leadership in meeting these goals. Initiatives were targeted across the supply chain to include multiple benefits including tighter inventory control, expanding patient assistance programs, improved accountability and budget assignments, and increasing communication and training.

Methods: Review of the previous six months drug spend was conducted for each pharmacy ordering area, including Satellites. Budgets were determined by taking the average monthly spends and applying a 10 percent reduction. Results were communicated on a weekly basis with the month to date spend and the percentage of the monthly budget that had been utilized. Communication with staff was a key success factor and helped to reinforce staff accountability. Reporting on a weekly basis allowed areas to make adjustments in a timely manner. Utilizing Six Sigma and Lean processes, staff and pharmacy leadership worked closely to streamline the inventory management process. Pharmacy supply chain was analyzed for inventory count accuracy, duplicate inventory, drug shortage management, contract optimization, wastage and unproductive inventory. Communication meetings provided additional training, discussion of issues being faced, communication regarding drug shortage challenges and to focus on inventory management. The use of Patient Assistance Programs was increased to help with medication reimbursement and cost avoidance

Results: A 969 bed academic medical center achieved a reduction in wholesaler drug spend of 3.8 million dollars over the previous six months as a result of this project. An inventory reduction of 2.7 million dollars was achieved from June 2012 to January 2013. This reduction represented a 33 percent decrease in inventory on hand. Drug cost containment was also aided by pursuing additional patient assistance programs. An additional \$283,579 in products was recovered for the hospital, in addition to the 11 drugs the hospital was currently seeking, from August 2012 to December 2012. The program continues to expand and assists patients with

home maintenance medications and also recovers some medical devices for the institution. Contract compliance optimization and purchasing efficiencies also resulted in an additional \$327,231 in drug cost containment. Sustainability was targeted throughout the project, as well as the ability to continue the project with pharmacy resident and student involvement. Total drug cost containment acknowledges economic considerations such as absolute reduction, cost avoidance, drug spend attenuation and cost avoidance.

Conclusion: This academic medical center successfully designed, implemented and quantified supply chain initiatives that accomplished pharmacy department financial goals, increased efficiency, encouraged staff accountability and enhanced work efficiencies in a six month period of time without compromising patient care. It is recommended that other institutions evaluate these supply chain initiatives.

3-007

Category: Administrative practice / Financial Management / Human Resources

Title: Intensive continuing education program prior to computerized prescriber order entry implementation

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Purpose: Implementation of computerized prescriber order entry (CPOE) provides the opportunity to change the pharmacy practice model by expanding clinical pharmacy services, as pharmacists will be more visible on patient care units. The objective was to enhance pharmacist clinical skills prior to computerized prescriber order entry implementation.

Methods: Our pharmacy department is accredited by the Accreditation Council for Pharmacy Education (ACPE). An intensive pharmacist educational program was designed and administered over a period of five months. This consisted of weekly one hour ACPE approved pharmacotherapy presentations. The presentations were live programs and included case studies to allow active participation and application of clinical skills. They were also offered as live webinars and repeated once to maximize attendance of pharmacists, including off shifts. The presentations were offered to all pharmacists in our healthcare system, as our sister hospitals were also preparing for CPOE implementation. The presenters were senior clinical specialists and clinical pharmacists. Clinical pharmacist presenters were mentored by clinical coordinators. Topics were chosen based on pharmacists interests and needs. After the completion of the educational program, pharmacists were surveyed about the effectiveness of the program.

Results: The program consisted of 19 presentation topics that were provided weekly over a period of five months. The topics included hypertension, acute coronary syndrome, heart failure, community acquired and nosocomial pneumonias, bacteremia and endocarditis, skin and soft tissue infections, osteomyelitis, diabetes, endocrine emergencies, stroke, seizures and epilepsy, anticoagulation, renal failure, acid base disorders, liver disease, asthma, COPD, pharmacokinetics, and pain management. The average number of participants per topic was 42. A total of 793 ACPE continuing education certificates were issued. In the survey administered after the completion of the education program, 93% of pharmacists rated the program beneficial for enhancing their clinical skills.

Conclusion: Pharmacist clinical skills were enhanced by an intensive continuing education program prior to CPOE implementation.

3-008

Category: Administrative practice / Financial Management / Human Resources

Title: Implementation of a centralized Pharmacy Remote Order Processing center (PROPc) for off-hour processing of medication orders for multiple hospitals within an integrated health delivery system

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Purpose: Summa Health System is a seven hospital system. Two of the hospitals pharmacies are open 24 hours while the remaining five hospitals relied on off-hour support from either the 24-hour pharmacies, a for-profit contracted service, or by pharmacy personnel the following day. These processes led to excessive burden for evening and night shifts at the supporting pharmacies as well as increased costs and error potential. Nursing satisfaction on these shifts was also concerning. A centralized service could cost-efficiently standardize and optimize care throughout the system, increase patient safety and potentially improve nursing staff satisfaction.

Methods: A model was designed such that a center would serve the five hospital pharmacies in Summa Health System that are not open 24 hours per day. In the center a single pharmacist would process medication orders from 7PM to 7AM Monday thru Friday and 3PM to 7AM on weekends and holidays. A core team of six pharmacists were trained on each of the hospitals pharmacy computer systems. As the pharmacist begins a shift, each nursing unit is called to identify if there are any immediate needs or issues that he/she should be aware of. During the shift the pharmacist will process all new medication orders including clarification of any orders, recommendations for appropriate order changes, and reporting of medication errors. Data that is tracked include: number of orders processed, number of phone calls, and number of logged interventions.

Results: On March 4, 2013 the PROPc opened and processed orders for St Thomas Hospital, Wadsworth Rittman Hospital, and Summa Rehab (Vibra) Hospital. The PROPc started processing orders for Western Reserve Hospital on March 17th and Crystal Clinic Orthopaedic Center on May 1st. From March 4th through May 31st the PROPc processed 35,883 orders, answered 852 phone calls, and documented 290 clinical interventions. In May, the first full month with all 5 hospitals being served, the PROPc processed 13,311 orders, answered 302 phone calls, and documented 61 clinical interventions. The projected monetary value of these 290 clinical interventions is \$14,398. All of this information is updated and reviewed monthly on a scorecard. The feedback regarding nursing satisfaction with the PROPc has been extremely

positive. An employee satisfaction survey is in development. We are in the process of expanding the service to hospitals outside of Summa Health System.

Conclusion: The PROPC has standardized the processing of off-hour orders for multiple hospitals which has helped to level workload, optimize safety, increase nursing satisfaction, and minimize expenses to all the facilities. The growth of this service will help generate revenue for Summa Health System while providing a service at an affordable rate for hospitals outside of our network.

3-009

Category: Administrative practice / Financial Management / Human Resources

Title: Implementation of three times daily small volume parenteral (SVP) processing using Lean methodology

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Purpose: Small volume parenteral (SVP) medications are batch-processed once daily. Medications are prepared and delivered for a 24-hour period. Factors including order changes and/or discontinuations in therapy or patients being transferred lead to increased rework, missing doses, and ultimately waste. The purpose of this project was to evaluate the process and identify opportunities for improvement. The current process was redesigned using Lean Thinking and associated tools. SVP processing was increased to three times daily to minimize waste, improve workflow, and decrease overall drug expenditure.

Methods: Four pharmacists with formal Lean training and an institutional Lean Master developed the project charter to establish the scope and goals. Stakeholders and front-line staff were engaged to identify potential issues and barriers to project implementation through Voice of Customer (VOC) interviews. The current and future state SVP processes were mapped outlining the new SVP schedule and defining pharmacist and technician roles and responsibilities. The SVP work and storage areas were reorganized using the Lean 5-S methodology (Sort, Store, Shine, Standardize, and Sustain). Documentation tools and standard operating procedures were developed to address management and staff concerns regarding changes to the distribution process. Electronic communication was distributed to all pharmacy and nursing personnel prior to implementation and 24-hour on-call support was provided by the Lean team for two weeks post-go-live. Hospital-wide purchasing and billing data were collected and analyzed for targeted high-cost medications. Observed and expected billing units (BUs) were calculated for each medication pre- and post- implementation. Increased BU ratios indicate possible increase in charge capture and decrease in overall drug expenditure.

Results: The VOC indicated the following opportunities for improvement: establishing consistent staff coverage in the SVP area for all shifts; creating a checklist of responsibilities per shift; developing optimal par levels for each medication; creating a call-out plan; and reorganizing the physical work space. The future state SVP process consists of three scheduled fills daily. No more than one dose of a medication is dispensed for most products, minimizing extra-processing and rework. The medications dispensed were a more accurate reflection of the patients' current medication profile. Although no physical changes to the SVP area could be

made, the 5-S approach helped optimize the work space. Key deliverables included SVP shift communication and fill logs, technician workflow checklist for all three shifts, and a call-out algorithm. BU ratios were analyzed for intravenous acetaminophen, amphotericin B, daptomycin, micafungin, and tigecycline. Preliminary data shows an increase in BU ratios for approximately 60% of the targeted medications. These findings may be attributed to increased charge capture and decreased drug waste.

Conclusion: By implementing three times daily SVP processing using Lean Thinking and its associated tools, we were able to minimize waste, increase charge capture, improve workflows, and thus decrease overall drug expenditure.

3-010

Category: Administrative practice / Financial Management / Human Resources

Title: Impact of opportunities in an academic health system pharmacy summer internship program

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Purpose: As a profession, pharmacists have a spectrum of work environments and specialties they can choose from. This academic health system pharmacy summer internship program encompasses experiences in pharmacy workflow, administration, clinical shadowing, and discussions in a variety of inpatient and outpatient settings across three entities. The purpose of this project is to show the development of a pharmacy summer internship program, describe the growth of the program, and evaluate the perceived value to those who completed an internship.

Methods: From 2008-2012, a count of the applications and number of positions each year was calculated with the assistance of Human Resources. The application requirements, screening process, and program requirements were compared and contrasted during this time period. A list of all student interns who completed the pharmacy summer internship program was compiled and contact information sought out. Anonymous surveys were sent electronically to individuals to determine what career path was taken, current position, perception of the value of the program, whether they recommended other students to apply, influence of the intern program on their career choices, and how the internship helped develop their communication skills.

Results: The number of applications increased each year and the number of positions increased as additional entities collaborated and joined the program. Overall, the application and program requirements remained constant while the screening process was modified as the number of applicants rose. The survey was sent in Fall 2012 to 110 past interns from years 2008-2012, in which 51 responses were received. One of the goals of the internship program is to expose interns to the specialized pharmacy services and career opportunities available in a large, non-profit, academic health system. The survey showed the majority of former interns chose to pursue further training opportunities after graduation, such as residency, fellowship, or other postgraduate training/certification. The survey results also confirmed that exposure to the variety of pharmacy careers and specialty areas during the internship helped interns to identify and confirm their own areas of interest to pursue in their professional career. The majority of respondents described marked improvement in their communication and presentation skills and provided positive feedback regarding the expansive networking opportunities available during their internship experience.

Conclusion: In addition to the growth of the number of interns, the program continues to evolve to provide interns with experiences in health system pharmacy, assist interns in identifying their practice interests, and foster their communication skills. The impact of the interns and their work on patient care, patient safety, quality improvement, and pharmacy services and workflow is invaluable and often is long lasting after interns complete their internship.

3-011

Category: Administrative practice / Financial Management / Human Resources

Title: Recruitment information preferences of recent pharmacy residency applicants

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Purpose: The recent steady increase in the number of residency applicants and residency programs has increased the need for applicants to discriminate among the many programs and for program directors to optimize their recruitment strategies by providing the most pertinent information in the most convenient form. Our study aimed to assess recent residency applicants preferences of types and sources of residency program information and materials in order to improve residency programs recruitment strategies.

Methods: A survey regarding recruitment information preferences was developed and distributed via email to 1,515 residency program directors compiled from the ASHP online residency program directory. Program directors were requested to forward the survey to current PGY-1 or PGY-2 residents and reply to the email with the number of residents to which the survey was forwarded. The survey included questions about demographics and the number of programs to which participants applied. Participants were also asked about pharmacy school experience influences on pursuing a residency and preferences for different types and sources of residency program information. Descriptive statistics were used to quantify responses. This study was determined to be exempt from full review by the Midwestern University IRB.

Results: A total of 192 program directors forwarded the survey to 522 PGY-1 and 207 PGY-2 residents. There were a total of 520 participants (PGY-1= 76.3%, PGY-2 =23%; response rate 71.3%). The most common age group was 26-30 years of age (n=277, 53.3%) and 71.3% (n=371) were female. Participants applied to a mean of 6.4 programs (SD= 3.7) for the 2012-2013 residency year. The most common activity in pharmacy school that helped participants prepare for a residency was experiential rotations (n=446, 85.8%) followed by lectures in a required course (n=277, 53.3%) and elective courses (n=251, 48.3%). Participants indicated that an introduction to residency training would have been the most meaningful during their first professional year (n=177, 34%). Participants noted that required (n=464) and elective learning experiences (n=463) and current positions of past residents (n=310) were very important information when selecting a program, and a program video (n=206) and preceptor curriculum vitas (n=128) were not as important. Participants ranked the programs website followed by a flash drive containing information about the program as the most preferred sources of information. Overall, 68.3% (n=341) of participants indicated that they agreed or strongly agreed that electronic information sources were preferred over paper information sources.

Conclusion: Residency programs should dedicate resources to ensuring that their website includes information regarding learning experiences and the current positions of past residents. Programs should also consider providing more information to applicants electronically rather than in paper form. Further study is needed to describe program attributes that aid potential applicants in deciding between programs.

3-012

Category: Administrative practice / Financial Management / Human Resources

Title: Economic impact of seven initiatives in a large academic health system

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Purpose: Hospital pharmacy departments have been historically challenged to reduce costs and given the more recent developments in healthcare, that demand has become even greater. To address this challenge, a large academic health system implemented seven clinical initiatives and calculated savings with a drug spend analytics software program.

Methods: Cost savings initiatives were identified based on safety, efficacy and then cost effectiveness; the team gained buy in from various health system departments and the initiatives were implemented. Seven initiatives were implemented which included: expansion of the antimicrobial stewardship program, a carbapenem therapeutic interchange, targeted antimicrobial monitoring, IVIG interchange, transplant drug optimization, thrombin waste reduction and optimization of anesthetic inhalation agents. A drug spend analysis software program was used to quantify the savings of these initiatives for one year after implementation with the prior year used as a baseline for measuring savings.

Results: A 632 bed health system achieved \$1,302,774 in savings (7 percent of total drug spend) by measuring cost savings over one year for each initiative. The largest cost savings initiatives included: transplant drug optimization (\$546K), targeted antimicrobial monitoring (\$478K) and thrombin waste reduction (\$170K). One limitation is that purchasing data were used as a proxy for utilization data. Due to the limitations surrounding gathering real time utilization data, purchasing data continue to be a feasible, reasonable source of consistent, accurate and efficient data.

Conclusion: By utilizing drug spend analytics software to identify potential clinical initiatives and collaboratively working with other departments within the health system, it is possible to successfully and efficiently implement and quantify initiatives that are based on safety and efficacy and cost savings.

3-013

Category: Administrative practice / Financial Management / Human Resources

Title: Initiation of a mock residency interview exercise for fourth year doctor of pharmacy students

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Purpose: The growing demand for post-graduate residency positions available to fourth year doctor of pharmacy students has exceeded the number of positions available. This trend has created increased competition among applicants, leading to students searching for unique ways to distinguish themselves from other applicants. Additionally, residency programs selection processes have become more formalized during the residency interview process. Traditional pharmacy education doesn't prepare students for structured interviews, thus causing anxiety and concern among students. This project was designed to enhance student interviewing skills prior to completing residency interviews in hopes of increasing the chances of obtaining a residency position.

Methods: A mock residency interview experience was created to provide a hands on experience of interviewing processes that could be encountered during residency interviews. Five pharmacy faculty and three current PGY1 pharmacy practice residents volunteered to develop and conduct this activity. All fourth year pharmacy students planning to apply to post-graduate residencies were encouraged to participate. Three separate activities which could be expected to occur during a structured residency interview were utilized: 1) one-on-one interview, 2) clinical case evaluation and presentation, and 3) panel interview. The one-on-one interview was with a faculty member posing as a residency director. This portion focused on why students wanted to complete a residency while also encouraging the student to practice asking questions about a particular program. The clinical case was to be completed in 20 minutes followed by a verbal case presentation to a faculty member. The group interview, consisting of three interviewers and the student, focused on structured behavioral interview questions. Students received feedback after all three scenarios. Two separate surveys were utilized to assess the students perception of this activity. The first survey was conducted immediately following the exercise while the second survey was conducted after residency interviews and the match process.

Results: Eleven students participated in the mock residency interviews. Following the exercise, 100% of students strongly agreed or tended to agree that they felt more comfortable with the types of questions that may be asked during residency interviews. In addition, 91% of students strongly agreed that they felt more confident in their interviewing skills. All eleven students

stated that they identified areas for improvement in their interviewing skills, said they would recommend this experience to future P4 students the following year, and stated that the constructive feedback provided was helpful. Students spent an average of 7.5 hours working on areas of identified weakness. The second survey post-match indicated that 81.8% of these students accepted a residency position, which is greater than the national average. Ninety-one percent of the students strongly agreed or tended to agree that the questions asked during their actual interviews were similar to the ones asked during the mock interviews, while 100% of students strongly agreed or tended to agree that the mock residency interviews enhanced their performance during the actual residency interviews. Additional student feedback regarding areas of improvement involved incorporating more questions from the director or manager perspective and possible inclusion of a short oral presentation.

Conclusion: Providing fourth year doctor of pharmacy students with interview experience via a mock interview proved to be beneficial. The students stated they felt more prepared and confident for the interview component in the residency application process. Student feedback regarding the mock interviews also provided suggestions for possible modifications to the experience next year.

3-014

Category: Administrative practice / Financial Management / Human Resources

Title: Pharmacy student characteristics associated with securing a post-graduate training program

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Purpose: Opportunities for post-graduate pharmacy training in the form of residencies and fellowships are becoming more competitive. Identifying factors that can help predict post-graduate success might help guide students in earlier years of the pharmacy program make more informed choices. The purpose of this study was to identify predictors for securing post-graduate training.

Methods: A 32-question, IRB-approved survey was administered to all fourth year pharmacy students at a large college of pharmacy in the Midwest (N=202). Survey questions were developed using the published literature and expert consensus and addressed a variety of different student experiences during pharmacy school. Questions in the survey that pertained to residency/fellowship pursuit included: leadership, work, and research experience; timing of clinical rotations; grade point average (GPA); number of programs applied to; number of interviews; and characteristics of the individuals who wrote their letter of recommendations.

Results: A total of 158 students completed the survey, for a response rate of 78%. A total of 35 (22%) of respondents indicated that they had pursued residency/fellowship training, of which 27 of these (77%) were successful in securing post-graduate training placement. All students who pursued residency/fellowship training had work experience, 79% had research experience, 79% had held leadership positions in organizations, and 97% had clinical rotations prior to Midyear. There was no difference in the number of programs applied to for those who matched and those who did not (mean 10.5 vs. 9.4, respectively). However, those who matched had more interviews than those who did not (mean 5.6 vs. 3, respectively, $p=0.038$). Students who matched were more likely to have had a clinical preceptor write their letter(s) of recommendation compared to those who did not match (100% vs. 75%, respectively, $p=0.047$). Students who matched also had a higher mean GPA than those who did not match (3.61 vs. 3.35, respectively, $p=0.019$).

Conclusion: A large majority of students pursuing residency/fellowship training had work, leadership, and research experience. Variables associated with successful placement in a residency or fellowship were number of interviews secured, letters of recommendation from

clinical preceptors, and higher GPA. This information can be used to help guide first, second, and third-year students who are seeking post-graduate training.

3-015

Category: Administrative Practice/ Financial Management / Human Resources

Title: Creating a standardizing medication formularies across a multi-hospital health system

Primary Author: Molly Leber, Yale New Haven Hospital, 20 York St-Department of Pharmacy, New Haven, CT, 06510; Email: MOLLY.LEBER@ynhh.org

Purpose: In 2010 Yale New Haven Health System, decided to change IT platforms to EPIC and implementation plans began with the goal to provide one record for each patient, regardless of where the patient receives care. To reach this goal, standardization of the three separate medication formularies and Drug Use Policy into one for the health system is the focus of this project submission. // Prior to undergoing this project, the Pharmacy Clinical Evaluation Committee (CEC) had been meeting on a monthly basis to discuss clinical, operational and financial opportunities and challenges. The CEC was comprised of the three Hospital Pharmacy Directors and clinical and operational support staff. The CEC collaborated on numerous clinical and financial cost savings projects; however, implementing these initiatives across the health system was often challenging. Without a single governance structure or common IT platform, often consensus was not achieved, decisions were delayed or never reached, and projects weren't implemented consistently at each delivery network. // The Formulary Integration Committee (FIC) was created to govern this process and incorporates the existing membership of the CEC and each hospital's Pharmacy and Therapeutics (P&T) Committee physician members. The goal of FIC was to standardize all three independent medication formularies into one Health System formulary to enhance medication safety, realize additional cost savings and facilitate clinical integration in medication management throughout the Health System.

Methods: To ensure that FIC was successful, meetings were conducted with the Directors of Pharmacy, CMOs, Nursing leaders and P&T Committee Chairs to establish FIC governance, authority, responsibilities and schedule. Much work was done to gain buy-in and address the vastly different cultures at each institution. Using elements of the Change Acceleration Process (CAP) methodology, the process of acceptance was greatly accelerated, resulting in significant accomplishments within the first year of the new process and group formation. Standardization in the formulary as well as policies and guidelines has streamlined the medication build in the EPIC system, allowed for operational efficiencies and safety enhancements, as well as yielded tremendous savings across the health system.

Results: Prior to the first FIC meeting, the Clinical Pharmacy Specialists reviewed all 3 institution formularies and identified similarities and differences. In this review, it was identified that 193 drugs needed to be added to one or more hospital formularies, 262 drugs needed to be deleted from one or more hospital formularies, 84 drugs needed further follow-up and 46 drug class reviews needed to be conducted. // Since implementation of FIC in May 2011, 1800 common line items were added to the health system formulary. The adult and pediatric continuous infusion concentrations, TPN formulations and intravenous medications formulations were standardized. A total of 23 drug class reviews have been conducted, 33 drugs reviewed of

which 31 were added and 2 denied formulary addition. In addition, to improve medication safety and enhance appropriate drug utilization, FIC has standardized 19 drug use policies, protocols and standing orders across the YNHHS. // In the first year, \$2.1 million in cost savings was identified through formulary standardization and contract enhancements, which included only direct drug cost; indirect costs such as inventory management, operational efficiencies were not included. The majority of savings, about \$1.5 million, were a result of medication standardization allowing for contract optimization or enhancement. Additional savings were the result of streamlining inventory, formulary deletions, and changing to more cost-effective therapies.

Conclusion: The success of FIC has shown that the implications for achieving increased safety and efficiency outcomes while managing cost is possible through health system interdisciplinary teams. FIC governance will be ongoing to continue the process of standardizing safe and effective medication use across the health system. As EPIC is implemented across the health system, this framework will allow for future enhancements in medication management and clinical integration efforts.

3-016

Category: Administrative Practice/ Financial Management / Human Resources

Title: A metric driven approach for measuring and improving clinical pharmacy services in a multi-hospital system

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Purpose:

Methods: The first step was to develop a comprehensive list of strategies and tactics by therapeutic group. This was done using a team of clinical pharmacists assigned to specific therapeutic groups. To assure consistency and reproducible results, information was included on how to score each indicator. Since the goal is to optimize and improve clinical performance, a suggested action plan was provided for each indicator along with any available resources such as articles, guidelines and protocols. Once the list of indicators by therapeutic group were compiled, an excel spreadsheet was developed. The assessment tool was then implemented by scoring each clinical indicator in 14 hospitals throughout the country. A baseline score was established for each hospital by therapeutic group as well as a roll-up score. Any indicator that did not meet the criteria resulted in specific actions placed on the hospitals strategic action plan for the year. Throughout the year, as hospitals implemented their strategic action plan, the assessment tool was updated to look for improved clinical pharmacy performance. The scores were also compiled to benchmark clinical performance with each other. The last part of this project was to look at the clinical pharmacy performance scores and compare it with other pharmacy metrics such as drug cost. The goal was to identify any correlation of lower drug costs associated with high or improved clinical performance scores.

Results: A total of 219 clinical assessment indicators were identified for thirteen therapeutic groups. A baseline assessment was done in 14 hospitals. The average baseline score for all hospitals was 70%. The follow-up assessments were not completed in all 14 hospitals at the time of this write-up, but will be presented in more detail at the 2013 ASHP Midyear Clinical Meeting. Results to be presented will include improvements in assessment score from baseline. Although follow-up assessments were not complete at all hospitals, a preliminary analysis of the baseline scores was conducted comparing the performance score for the anti-infective therapeutic group with the antibiotic costs for each hospital. The two metrics were graphed together and the trend line for each metric showed a positive correlation. For example, hospitals with a higher performance score for anti-infectives, had a lower anti-infective cost. Benchmark data will also be presented.

Conclusion: Implementing a clinical pharmacy assessment tool allowed a standardized and reproducible method to measure and improve clinical performance. The process helped identify clinical actions for the year to improve their clinical performance score.

3-017

Category: Ambulatory Care

Title: Outcomes and patient satisfaction with a pharmacist managed clinical video telemedicine (CVT) anticoagulation clinic

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Purpose: CVT is a method of telehealth providing real-time videoconferencing between VA medical centers and patients. CVT was implemented in a pharmacist managed anticoagulation clinic at the VA Maryland Health Care System (VAMHCS) in June 2012. The purpose of this study was to evaluate the effects of CVT on clinical outcomes and veteran satisfaction in an anticoagulation clinic. The primary objective of the study was to evaluate time in therapeutic range (TTR) for warfarin prior and post implementation of the CVT anticoagulation clinic. The secondary objective was to evaluate patient satisfaction post implementation of the CVT anticoagulation clinic.

Methods: Prior to commencement, this study was approved by the Institutional Review Board and VA Research and Development office. This is a single center study of patients followed in the pharmacist managed anticoagulation clinic at the Fort Howard Community Based Outpatient Clinic (CBOC). Patients were included if they were greater than 18 years of age, were followed at the Fort Howard Anticoagulation clinic for at least 6 months prior to CVT, were followed in the CVT anticoagulation clinic, and had an INR goal width of at least 1. Patients were excluded if they were started on warfarin or had an interruption in therapy during the 12-month study period, in the 1-month prior to the study period, or if any visits for anticoagulation management were face-face visits at other anticoagulation clinics during the study period. The Rosendaal method was used to calculate TTR, and a paired students t-test was used to compare TTR pre and post implementation of the CVT AC clinic. Descriptive statistics were performed for survey results as well as other data collected. Patients included in this study were offered the opportunity to complete voluntary, anonymous satisfaction surveys to assess their experience with the CVT clinic.

Results: Thirty-eight patients met inclusion criteria. Patients were all male, primarily Caucasian, mean age 77 (10.6), with atrial fibrillation or atrial flutter as the most common indication for anticoagulation. Mean pre-CVT TTR was 79.4% 18.8 versus 80.8% 16.1 for post-CVT TTR ($p=0.62$). Satisfaction survey response rate was 81.6%. Mean satisfaction survey score was 56.98 4.6 out of 60. There were no significant changes in reported missed doses per patient pre-CVT to post-CVT (0.39 0.71 versus 0.42 0.64, $p=0.86$), mean cancelled appointments per patient (0.76 1.1 versus 0.82 0.95, $p=0.80$), and mean no-show appointments per patient (0.24 0.54 versus 0.45 0.86, $p=0.08$).

Conclusion: There was no significant change in TTR after 6 months of implementation of the CVT AC clinic. Additionally survey results demonstrate overall patient satisfaction with this clinic. Results suggest that this pharmacist run CVT AC clinic is an effective method to deliver patient care to Veterans in remote locations without compromising quality of patient care received or patient satisfaction. Furthermore results will be utilized to facilitate the implementation of other pharmacist run CVT clinics within the VAMHCS.

3-018

Category: Ambulatory Care

Title: Evaluation of diabetic evidenced-based treatment outcomes in a patient centered medical home (PCMH)

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Purpose: Diabetes is an increasingly prevalent disease and is associated with substantial morbidity, mortality and health care costs. The Healthcare Effectiveness Data and Information Set (HEDIS) is a tool used by more than 90 percent of health care plans to measure performance on important dimensions of care and service. This data is validated through regular audition by process designed by the National Committee of Quality Assurance (NCQA). The purpose of this study is to evaluate the PCMHs outcomes in meeting diabetic evidenced-based treatment goals using national benchmark data provided by NCQAs State of Health Care Quality Report (SHCQR).

Methods: A retrospective analysis of diabetic patients seen at the internal medicine faculty practice (IMFP) was conducted between January 1, 2012 to December 31, 2012, one year after the practice became a recognized NCQA Level 3 PCMH. Patients were divided into two groups, group one had patients followed by only the IMFP residents/ faculty physicians and group two patients were followed by a multidisciplinary team (clinical pharmacist and the IMFP residents/ faculty physicians). The primary objective was measurement of glycemic control defined as having a glycosylated hemoglobin (HbA1C) value less than seven percent. Secondary outcomes identified were having a HbA1C value less than eight percent, low density lipoprotein (LDL) control defined as less than 100 gm/dL and blood pressure (BP) control defined as less than 140/80 mmHg. All groups were compared to the results of the 2012 NCQAs SHCQR. A Chi-square test was used for statistical analysis.

Results: A total of 60 patients were evaluated with 30 patients in each group. Patients in the group one showed statistically significant superiority compared to the goals set by SHCQR with 80 percent of patients attaining a HbA1C level less than eight percent ($p = 0.02$). Patients in group one did not reach statistical significance compared with SHCQR for HbA1C less than seven percent ($p = 0.12$), BP control ($p = 0.7$) and LDL control ($p = 0.17$). Patients in group two surpassed the goals set forth by the SHCQR and identified statistically significant superiority with 72 percent of patients attaining a HbA1C less than seven percent ($p < 0.01$), 80 percent of

patients attaining a HbA1C less than eight percent and 76 percent of patients reaching LDL control ($p = 0.02$). Patients in group two did not show statistical significance with respect to BP control ($p = 0.15$) as compared with SHCQR.

Conclusion: The PCMH met the evidence-based treatment goals for diabetes as identified in NCQAs State of Health Care Quality Report (SHCQR). Outcomes were surpassed and better control in diabetics was identified in patients who were followed by a multidisciplinary team, including a clinical pharmacist and the internal medicine physicians.

3-019

Category: Ambulatory Care

Title: An aspirin a day keeps the doctor away?: A review of appropriate use

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Purpose: The United States Preventative Services Task Force (USPSTF) updated their recommendations for the use of aspirin for the prevention of cardiovascular disease in 2009. This report assists in understanding when to put patients on aspirin for primary prevention. The purpose of this poster is to ensure that patients at The Veterans Affairs Black Hills Healthcare System (VA BHHCS) are either on aspirin appropriately or appropriately are not on aspirin.

Methods: A report was run to find all men seen by their primary care provider in a VA BHHCS primary care clinic during one weeks time. Each patient was then reviewed against the USPSTF recommendations.

Results: one hundred and eighty-three men were seen in a primary care clinic for the specified week. one hundred of these were on aspirin, 49 for primary prevention and 51 for secondary prevention. Of the 49 patients taking aspirin for primary prevention, benefit was greater than risk for 33 patients. Where 16 had risk that exceeded benefit. Of the original 183 patients, 83 were not on aspirin. seventy-six of these patients were on aspirin and 41 showed a benefit that exceeded risk. After accounting for adverse reactions and other medications thirty-two patients were not on aspirin that would potentially benefit.

Conclusion: In conclusion we found that there is room for improvement in the use of aspirin at VA BHHCS. Education will be performed to ensure patients are on aspirin appropriately or that they are appropriately not on aspirin.

Category: Ambulatory Care

Title: Irritable Bowel Syndrome in patients presenting to community pharmacies in Lebanon

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Purpose: Irritable bowel syndrome (IBS) is a functional, multifactorial disorder characterized by abdominal pain and altered bowel habit for at least 3 months, contributing to a variety of symptoms. Based on the American College of gastroenterology (ACG), IBS patients visit the doctor more frequently, use more diagnostic tests, and have lower quality of life. In addition it reports that IBS-D is more prevalent than IBS-C. Since no such data are available in Lebanon, and considering the burden of IBS, a study was conducted to detect IBS in patients presenting to community pharmacies and the most common medications dispensed for IBS.

Methods: A cross-sectional study was conducted from July to September 2012 in 85 community pharmacies across Lebanon. A data collection sheet was constructed based mainly on the ROME III criteria, and the IBS guidelines of ACG1 and AGA. Any patient who was dispensed an IBS-related medication, such as anti-diarrheal (anti-motility, antibiotic, others), antispasmodic, anti-flatulence, laxative (of any pharmacological class), and/or probiotic, was asked to participate in this study. The ROME III diagnostic question of IBS was initially asked and patients who met the criteria were considered to have IBS and answered the survey. Accordingly, patients were identified to have IBS-Constipation, IBS-Diarrhea, IBS-Mixed and IBS-Pain. To detect the most common medications used in each subtype, data was gathered on their current and past use of IBS-related medications, in addition to the use of antidepressants. In addition to the demographic information, all symptoms associated with the patients condition, including pain and bloating, were collected. Moreover, we gathered data about patients symptoms triggers, quality of life, non-pharmacologic treatment, and probiotic use. Furthermore, and to assess awareness on their condition, patients were asked what and how they know about their problem, and if and how many times they referred to a physician or endoscopic testing.

Results: A total of 1477 patients participated in the study. 1090 (73.8%) patients met the Rome III criteria and were subdivided into IBS-D (34.5%), IBS-C (28.0%), IBS-M (9.5%), and IBS-P (1.8%). Demographic information showed 59.3% were females, 80% aged less than 55 years and 56.7% smoked cigarettes and/or hookah. Antispasmodics (56.2%) and laxatives (37.5%) were the most commonly dispensed medications. Only 18.3% of patients were taking antimotility agents and 18% anti-diahreal antibiotic, mainly metronidazole. Only 7.9% of the patients were taking probiotics and 18.6% asking for antidepressants. Abdominal pain was equally reported in

patients with IBS-D and IBS-C (52% and 51%), where as bloating was more common in IBS-C than IBS-D (57% and 25%). 71.3% of patients had on/off symptoms. Gastroesophageal reflux disease (19%) and ulcer (13.7%) were the most common gastrointestinal disorders reported by these patients. Furthermore, stress (59.6%) and eating (54.5%) were the most common symptoms triggers. 65.7% of patients confirmed that their symptoms negatively affect their quality of life (QOL) and 71.8% underwent at least one colonoscopy. Around 55% of patients did not know what their problem was, and 84.7% reported very poor to average IBS knowledge. In addition, 26.2% of patients reported that their pharmacist informed them about their problem.

Conclusion: Irritable bowel syndrome appears to be highly prevalent among patients presenting to the Lebanese communities. IBS-D is the most common subtype detected in these patients. However, the lack of knowledge and understanding of this disease is commonly noticed among the Lebanese population. Knowing that IBS is a disease of young adulthood and the negative impact it has on the QOL, more attention should be placed on IBS detection, awareness, and management among the Lebanese population.

3-021

Category: Ambulatory Care

Title: Pilot study of pharmacist education of cardiac outpatients to improve medication comprehension

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Purpose: To develop a new ambulatory care service to counsel patients in Cardiac Rehabilitation. The objective was to determine if education provided by the pharmacy resident improved patients comprehension and adherence.

Methods: In this single center, prospective study, patients were enrolled from December 2012 to April 2013. Eligible patients were 18 years or older and enrolled in outpatient Cardiac Rehabilitation at Hunterdon Medical Center. Inpatients were excluded. At enrollment, patients were given a five question pre-survey to assess medication comprehension, perception of the importance of adherence, and which healthcare professional they would ask for questions about medications. Chart reviews were completed and individualized education was provided. Education sessions were scheduled for each new enrollee. Post-survey assessments were conducted.

Results: A total of 42 patients were enrolled, 9 were lost before the initial visit, 33 completed a pre-survey, 21 were counseled and completed a post-survey, and 12 were unable to schedule counseling. Endpoints were analyzed using the Student's T-test. The primary endpoint was a composite of change in survey score for comprehension of medication regimen, indication, and mechanism. The results showed a statistically significant improvement in comprehension following pharmacist-provided counseling (p less than 0.001). The secondary endpoint was change in survey score for each question concerning medication regimen (p equals 0.038), indication (p equals 0.01), and mechanism (p equals 0.038) separately, as well as patient rating of importance to adherence (p equals 0.28). Another secondary endpoint was change in preferred medication information resource from physician or nurse to pharmacist (p equals 0.016). All patients chose agree (n equals 9) or strongly agree (n equals 12) for rating helpfulness of counseling and education materials provided by the pharmacist.

Conclusion: Counseling by a pharmacist was shown to improve medication comprehension and patient perception of a pharmacist.

3-022

Category: Ambulatory Care

Title: Improving medication adherence using a refill synchronization program: a partnership between community pharmacy and a Medicare Advantage health plan

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Purpose: The primary objective of this project was to evaluate changes in medication adherence for patients in a Medicare Advantage Prescription Drug Plan (MA-PDP), who participated in a community pharmacy refill synchronization (sync) program. A secondary goal was to evaluate the impact of the program on the Center for Medicare and Medicaid Services (CMS) STAR rating on medication adherence measures.

Methods: A list of Tucson based Medicare Advantage Prescription Drug Plan (MA-PDP) patients, was provided to a centralized Frys Pharmacy office. Current patients, who filled their medications within Frys, were telephonically contacted regarding interest in synchronizing their medication refills, a reconciliation process culminating in one monthly visit for all medications. Patients were enrolled between October 2012 and February 2013. De identified information collected included sync date, demographics, and electronic prescription information. Medications included in the analyses were based on those identified by CMS National Drug Codes for the STAR adherence measures. For the primary objective, adherence pre-sync (180 days before) and post-sync (at least 90 days of follow-up) were compared using medication possession ratios (MPRs) and proportion of days (PDCs) covered. For the secondary analyses, the proportion of patients with PDCs greater than or equal to 80 percent pre-sync and post-sync, were compared. Demographic characteristics, and various adherence measures, were reported using descriptive and appropriate parametric statistical testing, respectively. Minitab version 16, with alpha equal to 0.05 was used for all statistical comparisons.

Results: One hundred ten (110) patients had medications synchronized. The average age was 66.3 years (standard deviation 11.9) and 67 (61 percent) were female. Patients had about 6 medications synchronized with 70-80 percent receiving a medication for hypertension, hypercholesterolemia, or Type 2 diabetes. The mean MPR improved by 5.5 percent (95 percent confidence interval (CI): 3-8, p value less than 0.0001) and PDC by 8.8 percent (95 percent CI: 6-12, p value less than 0.0001). The percent of patients with PDC greater than or equal to 0.8, a measure used for Medicare STAR rating, improved by 12-32 percent for all medication classes (all p values less than 0.05).

Conclusion: The initial results of this study show the positive impact a community pharmacy chain can have on medication adherence. Future analysis will focus on a longer follow up period, measure of patient satisfaction, use of a (case matched) control group and potentially targeting patients with poor baseline adherence.

3-023

Category: Ambulatory Care

Title: Impact of a pharmacist run medication therapy management clinic on hypertensive diabetic patients at a rural VA outpatient clinic

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Purpose: The purpose of this quality improvement project was to enhance patient care through utilization of an established pharmacist run medication therapy management (MTM) clinic and to determine if there were any differences in outcomes for diabetic hypertensive patients managed in the pharmacist run clinic compared to those that were not.

Methods: This was a quality improvement project approved through the VA Black Hills Health Care System (BHHCS) Pharmacy and Therapeutics Committee and cannot be applied to the general population. Patients who met project criteria were contacted to determine if they were interested in participating in the MTM clinic. Patients not interested in participating in the clinic were automatically placed in the usual care group. The primary endpoint of this project was to meet the ADA 2012 and JNC7 blood pressure goal <130/80 mmHg. Secondary endpoints included meeting the VA/DoD blood pressure goal <140/80 mmHg, VA External Peer Review Program (EPRP) blood pressure goal <140/90 mmHg, determine pharmacists impact on overall diabetes management, safety and cost-effectiveness data. A chart review and statistical analysis was completed after 3.5 months of enrollment in the MTM clinic.

Results: A total of 49 patients agreed to participate in the MTM clinic and 50 patients were automatically entered into the usual care group (provider managed patients). The primary endpoint (BP <130/80) was met by 28.6% of patients in the MTM group compared to 12.2% in the usual care group (p=0.004). A statistically significant difference was not found for the secondary blood pressure goals; however, more patients in the MTM group met these goals. Of the 49 patients enrolled in the MTM clinic, 8 had an A1c >8% and 10 had an LDL >100 mg/dL. Six of the patients with an A1c >8% and 9 of the patients with an LDL >100 mg/dL were managed by pharmacy. Statistically significantly more patients were placed on an angiotensin-converting enzyme inhibitor (ACE-I)/angiotensin II receptor blocker (ARB) or statin if indicated in the MTM group compared to the usual care group. There was no difference found between groups for initiation of aspirin or for hospitalizations, emergency visits and adverse drug reactions.

Conclusion: The results of this project show that a pharmacist run MTM clinic can improve patient care. Further research showing economic outcomes regarding the use of MTM clinics over a longer time period needs to be completed.

3-024

Category: Ambulatory Care

Title: Evaluation of the safety and effectiveness of 12 week monitoring of patients stable on warfarin at the UC Davis Anticoagulation Clinic

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Purpose: The purpose of this study is to investigate whether assessment of warfarin dosing every 12 weeks according to the 9th edition CHEST guideline recommendations is as safe and effective as assessment every 4 weeks in warfarin patients monitored by the UC Davis Anticoagulation Clinic.

Methods: UC Davis Anticoagulation clinic patients receiving long-term warfarin therapy who were therapeutically stable on warfarin, defined as patients with at least 6 previous months of consistent results within therapeutic range were contacted to change their INR follow-up to 12 weeks. A retrospective chart review was completed after 12 weeks to determine the number of patients whos INR remained within therapeutic range, the number of thrombotic and bleeding events, and the number of medication changes that went undetected during extended follow-up.

Results: 52 patients who met inclusion criteria were included in the study. These patients were on warfarin for a variety of indications including: atrial fibrillation/atrial flutter: 33 (average CHADS2 score =2.06), venous thromboembolism (DVT or PE): 10, heart valve replacement: 1, genetic hypercoagulable conditions: 3, and other: 5. After the completion of the extended 12 week follow-up 50% of patients stayed within strict therapeutic INR range of 2-3. However, 71.2% stayed within extended therapeutic range of 1.8-3.2. No major or minor bleeding events related to warfarin occurred during the extended follow-up period. There were also no venous thromboembolic events that occurred. There were 19 new medication changes that were made during the extended follow-up period, with 4 changes reported to the clinic by patients, and 15 undetected medication changes.

Conclusion: Extended 12 week follow-up is safe and effective for select low risk patients who have been stable on warfarin for greater than 6 months. Patients require ongoing education regarding informing the clinic of medication changes to detect for potential drug interactions.

3-025

Category: Ambulatory Care

Title: Pharmacy prepared Clinic administered immunotherapy

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Purpose: Purpose: In 2006, the United States Pharmacopeia (USP) proposed several revisions to its Ch. 797 on Sterile Compounding which included allergen preparation. These revisions became effective June 1, 2008. Subsequently Joint Commission also posted Beyond Use Dating (BUD) recommendations and standards. The impact of the USP 797 recommendations and Joint Commission standards on the preparation of Immunotherapy in the clinic was assessed. It was determined by our institution that the pharmacy is best equipped to meet the recommendations of USP chapter 797 and Joint Commission BUD standards and the preparation of all allergens was transferred to the ambulatory compounding pharmacy. The purpose of this poster is to summarize and describe this model of immunotherapy service in which the pharmacy prepares the allergens and the physician administers them.

Methods: Methods: Immunotherapy was being provided in 3 clinics medicine, ENT and pediatrics. A pharmacy immunotherapy preparation service was designed to meet the unique testing and treatment needs of all 3 clinics. Pharmacy services in model include testing and treatment products. Testing and treatment materials and specific allergens were identified for each clinic. A physician order process was created and customized for clinic. Treatment protocols were defined and pharmacy role was delineated. Beyond use dating for both testing and treatment products were determined and agreed upon. The immunotherapy service was integrated into prescription processing in terms of ordering and documentation. A mutually agreeable billing process was established and implemented.

Results: Results: A model of pharmacy prepared clinic administered immunotherapy designed and implemented successfully.

Conclusion: Pharmacy is best equipped to meet the recommendations of USP chapter 797 and Joint Commission BUD standards and the preparation of all allergens.

Category: Ambulatory Care

Title: Comparison of the prevalence rates of the KCNJ11 polymorphism (rs5219) between diabetes and non-diabetes patients using second-generation antipsychotic medications

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Purpose: The KCNJ11 gene encodes subunits for the adenosine triphosphate-sensitive potassium pump on pancreatic beta cells which secrete insulin. The rs5219 variant of the KCNJ11 gene has been associated with impaired insulin secretion. Use of second-generation antipsychotics (SGA) is linked to the development of diabetes mellitus (DM). The purpose of this study was to determine if patients in the underserved population with pre-diabetes and diabetes on SGA have a greater prevalence of the KCNJ11 polymorphism (rs5219) when compared with non-diabetes patients on SGA.

Methods: The institutional review board approved this cross-sectional study. Males and females who provided informed consent were included in the study if they were 18 years of age or older and on therapy with a SGA for a minimum of 6 months. Patients were excluded from the study if they were unable to spit into collection tube without assistance, actively experiencing hallucinations, admitted to an acute psychiatric facility within the past 30 days, pregnant or breastfeeding, had type 1 DM, or were using oral or injectable corticosteroids. Age, gender, ethnicity, baseline body mass index (BMI), baseline blood pressure and lipid levels, and current medications were obtained from medical charts. At the study visit the following values were obtained: spit sample, plasma glucose, hemoglobin A1c (A1c), weight, and blood pressure. Pyrosequencing was utilized for KCNJ11 genotyping. Patients with an A1c of 5.7% or greater (pre-diabetes or diabetes) were included in the diabetes group. Patients with an A1c of less than 5.7% were placed into the non-diabetes group. The primary outcome measure was the KCNJ11 genotype. Secondary outcomes included changes in A1c, BMI, blood pressure, and lipids. It was determined that 33 patients would yield an 80% power with an alpha of 5%.

Results: Twenty participants enrolled in this study with 11 in the diabetes group and 9 in the non-diabetes group. In the diabetes group, 2 patients had the rs5219 variant compared with 1 patient in the non-diabetes group ($p=0.999$). Among the diabetes patients, 9 patients were wild-type (did not have the variant gene) compared with 8 patients in the non-diabetes group ($p=0.999$). Within the diabetes group, the mean change in A1c with the rs5219 variant was + 0.2 0.10% whereas the wild type gene was -0.08 0.29% ($p=0.8094$). The change in BMI was + 0.45 2.15 kg/m² in patients with the gene variant and -0.08 0.29 kg/m² in wild-type patients

($p=0.3458$). In the non-diabetes group, the mean change in A1c with the rs5219 variant was + 0.5 0.00% and + 0.18 0.11% in the wild-type patients ($p=0.2433$). With regards to BMI, patients with the gene variant had a -1.1 0.00% kg/m² change compared with wild type patients who experienced a -2.44 1.14 kg/m² change ($p=0.9999$). Changes in other metabolic variables in patients with the gene variant between the diabetes group and the non-diabetes group were compared and no significant differences were found.

Conclusion: There was no significant difference found in the prevalence of the rs5219 variant between the diabetes and non-diabetes group. There were also no significant differences in metabolic changes between patients with and without the gene variant in both the diabetes and non-diabetes groups. Further research with a larger sample size needs to be conducted to elucidate the role of the rs5219 variant with regards to increased risk of developing type 2 diabetes mellitus and metabolic abnormalities in the underserved population on SGA.

3-027

Category: Ambulatory Care

Title: Novel approach to managing diabetes in the ambulatory care setting

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Purpose: The most recent American Diabetes Association and American Association of Clinical Endocrinologists diabetes guidelines emphasize a patient-centered approach for treating diabetes, but do not offer a lot of guidance and leave a lot open to clinical judgment. A way to manage diabetes that is truly patient-centered and focuses on the pathophysiology of diabetes was developed to help pharmacists at Geisinger Health System (GHS) who perform Medication Therapy Management (MTM) obtain better outcomes for their patients.

Methods: A new approach to the management of diabetes has been developed by pharmacists at Geisinger Health System. By educating the patient on their disease state, this makes the patient an active participant in their diabetes plan. Instead of prescribing medications from an algorithm in the guidelines, this program takes into consideration the patients dietary habits, activity, education level, and also their financial well being, in order to tailor the therapy to the patient depending on that patients specific needs. Medications used in diabetes treatment are utilized in a unique way based on specific pharmacokinetic and pharmacodynamic properties. Patients blood glucose patterns throughout the day are analyzed prior to a therapeutic plan being developed. The current available guidelines cause clinicians to often select therapies that target basal instead of meal coverage, which often leads to adequate fasting blood glucose at the expense of patients experiencing many hypoglycemic events along with high blood glucose throughout the rest of the day. With the method used at GHS to manage diabetes, the goal is to obtain a steady basal rate with adequate meal coverage and no hypoglycemic events.

Results: This method of managing diabetes has been successfully implemented since 2010. All pharmacists working in 38 ambulatory clinics throughout central and northeast Pennsylvania have been trained and shown competency in using this approach. As of March 31, 2013, there are 3551 patients currently enrolled in the MTM program that focuses primarily on diabetes, but also includes hyperlipidemia and hypertension. From December 1, 2010 through March 31, 2012, there were 2874 patients referred to the MTM program. A total of 264 patients participated in the MTM program for diabetes only, 227 for diabetes and hypertension, and 1759 for diabetes, hypertension, and hyperlipidemia. The percentage of patients who achieved goal HgbA1C during this time frame were 41, 44, 52, and 64 after three, six, nine, and twelve months in the MTM program, respectively. The average HgbA1C of patients referred to the MTM program was greater than 9 percent and overall, HgbA1C values decreased by 84 percent for the patients enrolled in the MTM program.

Conclusion: The approach to managing diabetes at Geisinger Health System has been successful in obtaining exceptional outcomes. This method should be considered for implementation nationwide and should be taken into consideration when developing the next set of diabetes guidelines.

3-028

Category: Ambulatory Care

Title: Effects of Fenofibrate 160mg vs. 54mg Conversion on Triglyceride Levels in Patients on Statin Therapy

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Purpose: .Fenofibrate is commonly initiated at 160mg per day in patients receiving statin therapy despite dosing instructions recommending starting doses as low as 54mg for the treatment of hypertriglyceridemia. To our knowledge, there is no published literature on direct comparisons of fenofibrate 54mg versus 160mg. The primary objective of this study was to measure the impact on triglyceride levels after converting patients on statin therapy from fenofibrate 160mg to 54mg per day.

Methods: .Adults on fenofibrate 160mg and statin therapy with recent triglyceride levels less than 200mg/dL were randomly assigned to receive fenofibrate 54mg or continue fenofibrate 160mg. Subjects received a fasting lipid panel, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and serum creatinine (SCr) lab at baseline and 6 to 10 weeks after study enrollment.

Results: .Fifty-four subjects met the study inclusion criteria and were analyzed; fifty-two subjects completed follow-up labs. Baseline parameters for the 54mg and 160mg groups were well matched. The percent change in triglyceride levels in the 54mg and 160mg groups was -14.61(28.68) and -6.12(31.73) respectively. Percent change in high-density lipoprotein (HDL), low-density lipoprotein (LDL), ALT, AST, and SCr was similar in each group. This study did not reach statistical power.

Conclusion: .There was not a significant difference in the percent change in triglyceride levels among statin users maintained on fenofibrate 160mg versus fenofibrate 54mg. Although power was not met, these results provide support to conduct additional studies to determine the necessity of initiating fenofibrate therapy at 160mg.

3-029

Category: Ambulatory Care

Title: Identifying causes of supratherapeutic INRs at the University of California, Davis Medical Center (UCDMC) anticoagulation clinic

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Purpose: To evaluate the trends of identifiable causes of supratherapeutic INR values at the (UCDMC) anticoagulation clinic.

Methods: This was a retrospective, nonrandomized, single-centered study. Adult patients with critical INR results defined as 5.0 or greater were included. Demographic information including age, sex, warfarin, indication, and target INR range were collected. Identifiable causes of supratherapeutic INR were categorized as follows: dietary change, drug interaction, food interaction, acute illness, first visit to clinic, incorrect dose administered, no follow up, or dose adjusted by outside clinician.

Results: The overall number of supratherapeutic INRs decreased during the 2010-2011 time period compared to similar studies conducted in previous years. Greater than 50% of incidences continue to have no identifiable cause. Drug-drug interactions and acute illnesses remain the most common identifiable causes of supratherapeutic INRs. Antibiotics continue to be the most common cause for drug-drug interactions, followed by concomitant use of amiodarone. Since the implementation of the BPA tool, it is more apparent that antibiotics continue to be the largest contribution to drug-drug interactions at 62% over the last year.

Conclusion: The introduction of the BPA tool has allowed clinic staff to notify patients about the need for blood tests on the same day the interacting drug is ordered, contributing to the decreasing trend of supratherapeutic INRs due to drug-drug interactions.

3-030

Category: Ambulatory Care

Title: Night terrors with donepezil and memantine: a patient case report

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Purpose:

Methods:

Results:

Conclusion:

3-031

Category: Ambulatory Care

Title: Therapeutics considerations for management of depression in the setting of cytochrome P450 2D6 and 2C19 deficiency: a patient case report

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Purpose:

Methods:

Results:

Conclusion:

3-032

Category: Ambulatory Care

Title: Impact of a transitional anticoagulation clinic: optimizing inpatient to outpatient care

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Purpose: Although anticoagulants are an effective treatment used to prevent clots from occurring, certain medications such as warfarin require careful monitoring. Anticoagulation clinics are designed to monitor the effects of anticoagulation therapy and provide patients with the education required to maintain therapeutic drug levels. Prior to the addition of the anticoagulation clinic patients remained hospitalized until their international normalized ratio (INR) was therapeutic. The study was designed to determine the average decreased length of hospital stay due to the services provided at the Anticoagulation clinic.

Methods: This is a retrospective study approved by the institutional review board. It included 100 patients, 18 years of age or older, seen at the anticoagulation clinic between July 2012 and January 2013. To be included in the study, patients were required to have a sub-therapeutic INR (less than 2) upon arrival and a therapeutic INR (between 2-3) prior to being discharged from the anticoagulation clinic. The primary outcome was decreased hospital length of stay and the associated costs savings, determined by calculating the average time (days) it took to get a patient to a therapeutic INR and multiplying it by the average cost related to it. Secondary analysis identified direct savings the health system incurred by managing indigent patients at the anticoagulation clinic.

Results: One hundred patients meeting the inclusion criteria were reviewed. Upon arrival, the INR ranged from 0.91 to 1.98 with the mean INR being 1.35. It took between 1 and 10 days for patients to have a therapeutic INR with the average being 3.59 days. The average cost per day of hospitalization for the health-system was \$817. The average cost savings due to decreased length of stay was \$2933 per patient. The secondary analysis confirmed 25 of the 100 patients reviewed were indigent patients which resulted in the health system directly saving \$73,325 if the patients were to remain hospitalized.

Conclusion: Anticoagulation clinic services leads to a decreased length of hospital stay for an average of 3.5 days. This results in an average cost savings of approximately \$3000 per patient. It also improves patient outcomes and avoids serious complications from lack of treatment.

3-033

Category: Ambulatory Care

Title: Evaluation of the efficacy, tolerability, and cost savings associated with the conversion of rosuvastatin to atorvastatin in a veteran population

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Purpose: Rosuvastatin and atorvastatin are both antilipidemic agents used for lowering low-density lipoprotein (LDL) cholesterol and for the primary and secondary prevention of Cardiovascular Disease (CVD). Rosuvastatin is generally recognized as being a more potent statin when compared to atorvastatin, however at higher doses, LDL lowering ability may be slightly attenuated. The purpose of this study was to determine if there was a significant difference in LDL concentration(s) after conversion from rosuvastatin to atorvastatin in veteran patients with coronary artery disease (CAD) or diabetes mellitus (DM) and LDL less than 100 mg/dL.

Methods: The institutional review board approved this retrospective medical record review. This study included men and women ages 18-88 with a diagnosis of CAD or DM and LDL less than 100 mg/dL, who were converted from rosuvastatin 40 mg to atorvastatin 80 mg daily between September 1, 2012 and December 31, 2012. Patients were required to have a LDL measured between January 1, 2012 and time of conversion (baseline), and an additional LDL measurement at least 6 weeks from time of conversion to end of study period, March 31, 2013 (follow-up). Patients were excluded if they had any other changes to their lipid lowering medications other than conversion between baseline and follow-up labs. Patients were placed into sub-groups based on their baseline LDL for evaluation: LDL less than 70 mg/dL, LDL 70-79 mg/dL, LDL 80-89 mg/dL and LDL 90-99 mg/dL. The primary outcome measure was change in LDL from baseline to follow-up, and a 6 percent change in LDL was determined to be significant. Secondary outcomes included tolerability and cost avoidance.

Results: 344 patients were included in this study. 136 patients had a baseline LDL less than 70 mg/dL, 81 had a baseline LDL between 70-79 mg/dL, 66 patients had a baseline LDL between 80-89 mg/dL and 61 patients had a baseline LDL between 90-99 mg/dL. All groups evaluated experienced an increase in LDL. Median LDL increased 26 percent from 55.3 mg/dL to 74.5 mg/dL (IQR -28.3 to -1.6, p-value less than 0.0001) in patients with a baseline LDL less than 70 mg/dL. Median LDL increased 15 percent from 75.2 mg/dL to 88.9 mg/dL (IQR -21.4 to 0, p-value less than 0.0001) in patients with a baseline LDL between 70-79 mg/dL. In patients with a baseline LDL 80-89 mg/dL, median LDL increased 9 percent from 84.9 mg/dL to 94.7 mg/dL (IQR -17.8 to 6, p=0.0175), and in patients with baseline LDL 90-99 mg/dL, median LDL increased 7 percent from 93.8 mg/dL to 101.4 mg/dL (IQR -18.8 to 8.4, p=0.0495). Overall,

median LDL increased from 72.5 mg/dL at baseline to 86.5 mg/dL after conversion. Only 6 patients (1.7 percent) had a documented ADR to atorvastatin. It was estimated that converting 338 patients from rosuvastatin to atorvastatin resulted in an annual medication cost savings of \$83,891.60.

Conclusion: Rosuvastatin 40 mg daily provides superior LDL lowering when compared to atorvastatin 80 mg daily. Although median LDL increased from baseline, 77 percent (266/344) of patients were able to maintain a LDL of less than 100 mg/dL following conversion. Atorvastatin was well tolerated and conversion was associated with significant cost savings. Atorvastatin 80 mg daily may be considered an appropriate alternative to rosuvastatin 40 mg daily in many patients, with close follow-up monitoring of LDL to ensure that individual LDL goals are maintained.

3-034

Category: Ambulatory Care

Title: Simple self-titration in diabetic veterans (SST-VA): clinical outcomes of daily patient-directed basal insulin titration

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Purpose: Several insulin dosing algorithms exist to encourage increased patient involvement in self-titration of basal insulin. The majority of these algorithms utilize either weekly or every 2-3 day dose titration based on fasting blood glucose targets in patients who are insulin nave. Currently, data evaluating the use of daily insulin self-titration algorithms are limited. The purpose of this study was to determine the clinical outcomes of utilizing a simple self-titration (SST) algorithm to titrate basal insulin in a group of poorly controlled diabetic veterans.

Methods: This study was approved by institutional review board as a retrospective medical record review. Type 2 diabetic veterans followed in the Charleston, South Carolina VA Medical Centers Cardiovascular Risk Reduction Clinics (CRRC) between September 1, 2009 and December 31, 2012 were screened for use of a SST algorithm (increase daily basal insulin by 1 unit per dose to target a blood glucose of less than 130-150 mg/dL) to self-titrate their basal insulin. Patients were included if they had an A1c greater than 9 percent measured at least 135 days prior to first CRRC visit (baseline) and follow-up A1c measured at either 3 months or 6 months plus or minus 45 days. Patients were excluded if they failed to utilize the SST algorithm, required prandial insulin, or were converted to concentrated U-500 insulin. The primary outcome measure was mean change in A1c before and after implementation of SST at 3 and 6 months, with data evaluated on an intent-to-treat basis. A1c results were carried forward if a measurement was not available during a specific time frame. Secondary outcomes included change in weight, body mass index (BMI), and total daily insulin dose, as well as a descriptive analysis of adverse events.

Results: 55 patients were included in this study. Mean A1c at baseline was 11.1 percent. A1c decreased by 2.2 at follow-up to 8.9 percent at 90 days (p value less than 0.0001) and 8.5 percent at 180 days (p value less than 0.0001). Mean weight increased slightly from 106.6 kg to 108.3 kg at follow-up; BMI also increased slightly from 34.5 kg/m² to 35 kg/m², however neither was statistically significant (p values = .081 and .1044, respectively). Total daily insulin dose increased from 22 units at baseline to 62 units at follow-up (p value less than 0.0001). There were no documented reports of significant hypoglycemia as a result of utilizing the SST algorithm.

Conclusion: Use of a simple self-titration algorithm was effective in significantly reducing A1c in a veteran population and was not associated with any significant hypoglycemia. Increases in both weight and BMI were noted, however not found to be clinically significant.

3-035

Category: Ambulatory Care

Title: Evaluating the impact of a clinical pharmacist on diabetes, hypertension, and dyslipidemia in a Rural Clinic

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Purpose: To evaluate the impact of a clinical pharmacist in remotely managing diabetes, hypertension, and dyslipidemia in an effort to improve health outcomes for rural patients.

Methods: A retrospective chart review of 65 patients who were referred to and consulted with the clinical pharmacist for chronic disease management between October 1, 2011 and January 31, 2013 at the Clearlake Community Based Outpatient Clinic (CBOC). The hemoglobin A1C (A1C), blood pressure (BP), and low density lipoprotein cholesterol (LDL) prior to consultation with clinical pharmacist was compared to those obtained at the end of study period. The percentage of patients that achieve their goal A1C, BP, or LDL as determined by the Primary Care Provider (PCP), the incidences of medication adverse effects during the study period, and the workload of this model will also be determined.

Results: Clinical pharmacist remote management significantly decreased A1C by 1.08 percentage points (12.09 percent, p-value equals 0.0007) and significantly decreased LDL 30.78 mg/dl (22.18 percent, p-value equals 0.0341). Overall, 30 to 80 percent of patients were able to reach their clinical goals as determined by their PCP. This model involved an average of 5 telephone visits of 15 minutes in length over a period of 6 months per patient. Most pharmacist interventions were medication adjustments.

Conclusion: Clinical pharmacist remote management is effective in improving diabetes, lipid, and blood pressure values.

Category: Automation / Informatics

Title: Improving the chemotherapy dispensing process utilizing lean methodology in a hospital

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Purpose: Lean methodology has been used as a process management philosophy aimed at maximizing customer value while minimizing waste. Its principles of increasing efficiency and continuously seeking to optimize processes has led to its implementation in a wide variety of industries. There have been multiple published studies assessing the performance of lean production in a health care setting. This study sought to utilize lean methodology in an attempt to improve the chemotherapy dispensing process at an acute-care teaching and research hospital.

Methods: The first step in a process improvement is to map and analyze the workflow to create an in-depth understanding of the entire process and to identify opportunities for improvement. The workflow of the entire chemotherapy dispensing procedure was mapped and subdivided into three distinct steps: (1) Time spent between when the order was scanned and order entry, (2) Time spent between pharmacist-performed order entry and when the final chemotherapy product was ready for delivery, and (3) Time spent for chemotherapy product delivery to the oncology infusion center. A fourth marker, the total turnaround time (TAT) for the entire process was also highlighted. This study consisted of three phases of data collection, measuring the amount of time spent during the order and delivery process of chemotherapy medication to the infusion center. Phase 1 data collection took place when the oncology pharmacy and the infusion center were on different floors and wings of the hospital. Phase 2 data collection was done after the relocation of the infusion center to a site closer to the pharmacy. Phase 3 data collection took place after the delivery robot was introduced. A cost analysis of the robot was also performed in this study.

Results: In Phase 1, the median time between order scanning and order entry was 15 minutes, between order entry and the final chemotherapy product was 28 minutes, the delivery time was 12 minutes, and the total turnaround time (TAT) for the entire process was 55 minutes. The average percentage of each order spent in the delivery step was 21.82%. In Phase 2, the median time between order scanning and order entry was 13 minutes and between order entry and the final chemotherapy product was 25 minutes, the delivery time was 6 minutes, and the TAT for the entire process was 44 minutes. The average percentage of each order spent in the delivery step was 13.64%. In Phase 3, the median time between order scanning and order entry was 11 minutes, between order entry and final chemotherapy product was 34 minutes, the delivery time for each order was 4 minutes, and the TAT for the entire process was 49 minutes. The average

percentage of each order spent in the delivery step was 8.16%. Cost analysis showed that implementation of the delivery robot generated an annual cost savings of \$17,600 (annual leasing cost compared to one full-time employee).

Conclusion: Utilizing lean methodology, the delivery time for each chemotherapy order was reduced significantly. Utilization of the delivery robot also showed an additional cost savings as well as positive response from nursing staff. Nurses noticed the quicker turnaround time of chemotherapy medication delivery. They noted that this had an overall improvement on patient experience and satisfaction. This study found that the combination of relocating the oncology infusion center to a site closer to the oncology pharmacy and implementation of a delivery robot decreased patient waiting times and improved satisfaction without compromising quality of care; thereby improving patient experience.

3-037

Category: Automation / Informatics

Title: Evaluation of computerized prescriber order entry (CPOE) alerts for use and effectiveness

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Purpose: UAB utilizes computerized prescriber order entry (CPOE) with clinical decision support. Clinical decision support can be described as alerts that display information from the patients medical record to help inform decision making. However, too many alerts can lead to alert fatigue, or ignoring important alerts along with unimportant alerts due to overexposure. A balance is required between usefulness and effectiveness. The primary objective of this study is evaluate four CPOE alerts implemented within the last year to determine how often the alerts are activated, the appropriateness of the alert, and any improvements that need to be made to the alerts.

Methods: The alerts reviewed were the Parkinsons disease/dopamine antagonist alert, the dopamine agonist/dopamine antagonist alert, the meperidine/renal function alert, and the epidural/anticoagulant alert. Reports for the selected alerts were evaluated for a three month period (December 2012-February 2013). These reports were used to determine how often the alert fired for each medication order, if the alert was overridden, and if the alert functioned as designed. The patients charts were then reviewed to supplement the information from the report.

Results: The Parkinsons disease/dopamine antagonist rule activated 25 times for 12 patients; this rule was effective and functioned appropriately. The dopamine agonist/dopamine antagonist rule was activated 48 times for 27 patients; there were 2 patients for whom this rule may have been overridden inappropriately. The remaining overrides were appropriate. The meperidine/renal function rule was activated 86 times for 35 patients. Thirteen potentially inappropriate orders were prevented by this rule. The epidural/anticoagulant alert was activated 1,992 times in the three month period; the report, however, did not accurately record the agents that prompted the alert.

Conclusion: The Parkinsons disease/dopamine antagonist rule, the dopamine agonist/antagonist rule, and the meperidine/ renal function rules functioned appropriately. The epidural/anticoagulant alert did not record medication triggers accurately. Adjustments to the meperidine/renal function rule may include more specific reasons for override. The epidural/anticoagulant rule changes will include changes in how alerts are activated and/or recorded.

3-038

Category: Automation / Informatics

Title: Recognizing and identifying obstacles to the utilization of point of care technology in the emergency room setting

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Purpose: Medication administration is believed to be the stage at which most medication errors occur. Bar-code scanning, using a point of care (POC) device can be instrumental in the verification of the patients 5 rights thereby effectively decreasing these potential errors. In January of 2013, our 99 bed rural medical center implemented bar-code scanning hospital wide. The purpose of this study was to determine if there is a lack of scanning compliance with our emergency room (ER)nursing personnel and if so, the reason for non-compliance.

Methods: Reports were obtained from the clinical information services (IS) department to determine POC nursing scanning compliance in the ER from January 2013 to May 2013. Post-conversion assessment by an independent party was reviewed & nursing staff was interviewed to determine reasons for not utilizing the available technology.

Results: Review of medication scanning compliance in the 5 month period uncovered a continual monthly drop in emergency room nursing compliance from 26% in January to less than 1% in May. Post conversion assessment review revealed the most common complaints were screen size and the dislike of the stylus, double documentation, multiple charting elements for one medication, and alert fatigue. Also, nursing personnel requested that an IS department representative observe workflow in the ER to help identify other problems. Nursing interviews further revealed that the most common reason for noncompliance was time (fast patient turnover rate). Additionally, nurses stated that the process took too long, devices timed out between patients, combination medications were not easily scanned, and medication diluents, when required, were not ordered.

Conclusion: Scanning has been effectively abandoned in the ER. To reinstate POC technology and ensure patient safety, it is imperative that nursing leadership, the pharmacy department and IS work closely together to address individual nursing concerns and overall workflow challenges.

3-039

Category: Automation / Informatics

Title: Improving safety of refrigerated medications stored on patient care units

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Purpose: Look-alike sound-alike medications continue to be one of the most common root causes of medication errors. While technology such as automated dispensing cabinets and bar code validation decreases look-alike sound-alike medication errors, especially at the time of administration, proper storage of these medications is still an important safeguard and is required by The Joint Commission. Even with automated dispensing cabinets the storage of refrigerated medications may be problematic. The purpose of this poster is to present a simple, inexpensive, and elegant process which limits caregiver access to the refrigerated medication requested via the automated dispensing cabinet.

Methods: The electronic locking devices used by automatic dispensing cabinets to secure the refrigerator doors were eliminated. Medications were secured in individual locking drawers affixed to the inside of the refrigerators so they could not be easily removed. The locking drawer units were made of acrylic and available in single rows with 3 or 5 drawers per row. This configuration allowed for scalability depending on the medication size and the number of medications stored per patient care unit. Drawers and keys were numbered and keys were stored in high security bins in the automated dispensing cabinets with one key per high security bin. Refrigerated medications were loaded to the automated dispensing cabinet bins containing a numbered key but the medications were stored in the corresponding numbered bin located in the refrigerator. A new refrigerated medication retrieval process was defined. When a nurse retrieves a refrigerated medication from the automated dispensing cabinet, the high security bin containing the drawer key opens. The caregiver matches the key number with the drawer number, unlocks the drawer containing the medication, removes the amount of medication requested, relocks the drawer and returns the key to the high security bin.

Results: Since implementation of individual locked drawers to store refrigerated medications in November 2011, no look-alike sound-alike medication errors have been reported. In the two years prior to implementation multiple such errors were reported with severity levels ranging from additional observation to patient harm. Limiting caregiver access to refrigerated medications has also prevented the grazing habit that may be observed when access is granted to multiple medications in a single storage location. Depending on need, patient care units have one to four scalable cassettes containing 5 to 25 locking drawers with an average of 10 locking bins per unit. Two problems that were anticipated that have not occurred are key loss and refrigerated drawers left unlocked. To date, no keys have been misplaced, and drawers are always found

locked, even with robust surveillance systems in place. The only negative result has been the use of multiple high security drawers for key storage. For a few locations, such as the Trauma Emergency Center, additional high security bins had to be purchased.

Conclusion: The use of automated dispensing cabinets combined with locking bins located in unit based medication refrigerators has prevented medication errors and increased medication storage security within the Saint Francis Health System. The process has also decreased out-of-stock refrigerated medications by preventing grazing behavior. Both of these improvements have occurred without disrupting either pharmacy or nursing workflow. Finally, this process and the added safety and security it provides for refrigerated medications has provided other opportunities for improvement such as pre-staging compounded critical care drips.

3-040

Category: Automation / Informatics

Title: Impact of the Informatics Pharmacist in a Community Hospital Setting

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Purpose: Evaluate the impact of the implementation of a Informatics Pharmacist position on the healthcare outcomes in the acute care setting.

Methods: The Informatics (IT) Pharmacist position was implemented in mid 2008, at Mercy Hospital. Initial responsibilities included: software formulary management, charge reviews, maintaining dispensing machines and pre-packing machines inventories and monitoring interfaces. The position developed into standardizing medication order entry, standardization of IV medications, developing templates of all preprinted forms to decrease order entry time and improve medication safety. All of these preparations took place in order for Central Order Entry (COE) Pharmacists successful implementation in May 2012. Also, in the same month, Computerized Provider Order Entry (CPOE) was initiated in Mercy Hospitals Emergency Department. Order entry templates were developed to ease physician order entry based on diagnosis. The IT Pharmacist built all the order sets for the Emergency Department, with the approval of the ED Director. Careful attention was placed on building these orders using medications already in the Emergency Departments dispensing machines, thereby, decreasing time for medication administration. Medication shortages, a real difficulty for all of us in the community hospital setting, are addressed effectively via CPOE by alerting providers of shortages and alternatives.

Results: Since, the inception of the IT Pharmacist position at Mercy Hospital, over 2500 medications have been reviewed by the IT Pharmacist. All medications including chemotherapies and IV medications in the hospital formulary have been prebuilt in the hospitals computer system to ease order entry and decrease order entry errors. All pre-printed order forms have also been entered into the system, allowing for easier and faster order entry. Drug-specific labs have been added to display upon order entry alerting pharmacists at order entry. Software rules have also been added to alert pharmacists of contraindications of medications. For example, metformin will alert a pharmacist if a patients serum creatinine is elevated. One of the goals of the position is to facilitate order entry for Central Order Entry (COE) Pharmacists, to allow hospital pharmacists time for daily clinical interventions. In the ED department, order entry by providers has decreased time medication administration. Shortages and alternatives to them are seen by providers upon order entry also decreasing time of medication administration.

Conclusion: Informatics Pharmacist position began as a maintenance of software position. The position has developed to include the build of forms and sets to ease order entry not only for

pharmacists but for other providers. The goals of these projects are to increase medication safety while also decreasing time to administration. In addition, the difficulties of medication procurement these last few months have been addressed in an effective manner with the use of CPOE software.

3-041

Category: Automation / Informatics

Title: Automation in a hospital pharmacy: a Brazilian experience with automated dispensing cabinets

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Purpose: Automation in Brazilian hospital pharmacies is still relatively new. The use of automated dispensing cabinets (ADCs) started in the last decade but were only implemented in those hospitals having higher purchasing power. In south Brazil the first hospital adopted this technology only in 2010 to enhance its medication management processes. The aim of this analysis is to describe the hospitals implementation and expansion program of ADC automation.

Methods: The institutions ADC automation began in May 2009 with a needs survey for integrating between the hospital systems. Integration testing, then, occurred from January to March 2010. It was determined that the integration processes would be applied to: Admissions and discharged patients, prescriptions, dispensing and Returns orders. The first implementation occurred at the Obstetric Center in April of 2010. In 2011, the technology was deployed in four new areas: the Cardiovascular/Neurological Admissions and Pediatric Intensive Care Units in January, 2011; the Inpatient Maternity Unit and Emergency Obstetric Care in March 2011; and the Neonatal Intensive Care Unit in November of 2011. In 2012 seven more ADCs were purchased for both the clinical and the post surgical areas. The implemented routines were based upon the Guidance on the Interdisciplinary Safe Use of Automated Dispensing Cabinets (2008) produced by the Institute for Safe Medication Practices. All ADCs are integrated with computerized prescriber order entry (CPOE), and the inventory fluctuations are monitored through a business intelligence (BI) tool capable of indicating operational errors and failures in the integration process.

Results: To this point in time we have a total of eleven machines deployed. The greatest challenge to expanding the number of ADCs has been the high cost of the technology. Integration between systems is the more complicated portion of the process, needing, as it does a high degree of monitoring there were observed an average of five errors per cabinet within any 24 hour period of operation. On the positive side, however, the pharmacy reduced its percentages of returned orders from between 70% and 80%, and we observed a change in pharmacy and nurse workflow as well as increased safety associated with the dispensing of medications.

Conclusion: The implementation of the ADCs has created new demands and new routines for the pharmacy. For our process, it was necessary to organize a new structure to support both the care units and continuous training teams. The search for improvements in the integration process

is also carried out continuously by the information technology staff of the institution. However, the observed advantages include a reduction of the costs for better organizing the consumption, returns, and inventory discrepancies. Also advantageous were the increased satisfaction, safety, and speed of attendance experienced by the care team.

3-042

Category: Automation / Informatics

Title: Electronic health record optimization to prevent as-needed (PRN) medication therapeutic duplications

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Purpose: Optimizing computerized prescriber order entry in electronic health records is imperative for maintaining a robust and agile system. Prescriber alert fatigue from interruptive decision support systems are a major source of user frustration yet balancing patient safety while limiting the frequencies and types of EHR alerts remains challenging. Joint Commission's (JC) Medication Management (MM) standards require therapeutic duplication review but recent JC surveys show that ordersets and the difficulty in tailoring PRN therapeutic duplication alerts allow multiple medications to be ordered for the same indication, without clear criteria for selecting the use of one medication over another.

Methods: Dynamic, electronic lists selecting patients with as-needed (PRN) pain or antiemetic medications were manually created, including patients admitted to the emergency room, acute care and perioperative areas that populate upon EHR login. The pharmacist manually saves the list and reviews the PRN indications for each agent, saving only those patients with therapeutic duplications. Intervention to clarify the indication is made in the duplicate orders and acceptance rates are saved into a spreadsheet, initially by calling each prescriber for clarification. Once the scope of the issue was realized, the Medical Staff approved a stepwise procedure for the treatment of pain and nausea or vomiting that allows the pharmacist to clarify duplicate PRNs without changing the intent of the original, unclear order. Pharmacists now effectively clarify the criteria for use of certain medications without contacting the prescriber and without delaying patient care. In tandem, attempts to implement lasting electronic changes within the EHR system through orderset optimization and duplicate alerts for exact PRN reasons are ongoing.

Results: The most common reasons for therapeutically duplicated PRN medications are prescribing through ordersets containing agents with identical PRN reasons without clear criteria for use, an inefficient medication reconciliation process allowing orders without PRN reasons, and the narrow scope of duplicate firing programmed in the EHR. Multidisciplinary meetings resulted in a pharmacy-led, novel approach limiting PRN therapeutic duplications for pain and antiemetic medications. Initial attempts at contacting the prescriber for clarification were met with limited success. Following medical staff approval, a novel process where the pharmacist

corrects the PRN reason without contacting the prescriber or changing the intent of the medication order based on criteria improved compliance but remains a manual process, limiting the solutions effectiveness. Concurrent review of all EHR ordersets by an entity-wide pharmacy Clinical Effectiveness Team and optimization of the admission ordersets has improved compliance. Meanwhile, the EHR Team has created a hard-stop alert for duplicate PRN reasons that is running in the background but has not yet been implemented in the live system. Nursing education and the importance of clear PRN indications at medication reconciliation is ongoing and implementation of an electronic orders reconciliation module will limit the ordering of medications without clear criteria for use.

Conclusion: A significant challenge remains in tailoring EHR alerts to prevent overlapping PRN indications without affecting system performance or causing alert fatigue. Clear, step-wise approaches to pain and nausea management by the medical staff allow pharmacists to clarify orders without delaying patient care or harassing prescribers. Manual, multi-step processes are ineffective, time-consuming, and unsustainable. Orderset optimization and alert tailoring is needed to maintain MM compliance, specifically by reviewing all ordersets to limit the propagation of PRNs without clear criteria for use. Additional solutions include expanding PRN definitions and medication reconciliation modules with clear indications for use of home medications.

Category: Chronic / Managed Care

Title: Prevalence of vitamin B12 deficiency among Lebanese diabetic population and increase level awareness for chronic metformin users

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Purpose: Metformin constitutes a cornerstone in the management of type II diabetes mellitus. Primarily, it suppresses hepatic gluconeogenesis, and enhances the prognosis of diabetes by improving insulin sensitivity and protecting against vascular complications. Clinically relevant side effect of metformin is vitamin B12 deficiency that is well identified, frequently ignored, neglected and not uniformly checked for. The primary objectives of the study are to identify the prevalence of vitamin B12 deficiency in a Lebanese type II diabetic population & to assess the role of pharmacist in increasing awareness among patients regarding diabetes and metformin use. The secondary objective is to evaluate the association between metformin dose and duration of therapy with vitamin B12 deficiency.

Methods: This is a prospective multicenter observational study conducted from December 2012 to May 2013 and approved by the Institutional Review Board (IRB). Records of 102 patients with type II diabetes mellitus aged 34 to 85 years (mean 57.7) who were treated with metformin for more than 18 months were reviewed. Patients were excluded if they had been on metformin for less than 18 months or if they had pernicious anemia, stomach or bowel disease, bowel surgery, pancreatic insufficiency, chronic renal failure, liver disease, acid-base disturbance or cancer. The vitamin B12 level was recorded using Beckman Coulter Immunoassay Systems. Patient completed a questionnaire before an active, practical and written counseling is provided. Same scores were used to assess patient awareness before and after counseling and analyzed using paired sample students T-test. Patients were divided into 3 groups according to their current daily metformin doses: 1.0 g or less, more than 1.0 g to 2.0 g, or more than 2.0 g to 3.0 g. The duration of therapy with metformin were divided into those who were on metformin therapy for more than five years and those who had taken it for less than five years.

Results: A total of 102 patients fulfilled the criteria were enrolled in the study; 12 patients were excluded. Serum B12 levels ranged from a lowest level of 83 pg/ml to the highest level of 1513 pg/ mL with a mean of 361.4 pg/ml. 16.8% were deficient with a level less than 180 pg/ml. The mean difference in the level of awareness regarding diabetes and its treatment mainly metformin & its relation to vitamin B 12 level was 5.642 with a p value of <0.0001. The mean level of vitamin B12 concentration in cases receiving more than 2.0 to 3.0 g/day is 235 pg/ml which is lower than in those receiving more than 1.0 to 2.0 g/day (431.24 pg/ ml) and those receiving 1.0

g/day or less (320 pg/ml). Patients taking metformin for less than 5 years had an average vitamin B12 of 373.5 pg/ml, compared to an average vitamin B12 of 355.24 pg/ml in those patients receiving it for more than five years.

Conclusion: Finding a prevalence of 16.8 % raises the question of whether to screen for B12 deficiency in all patients receiving metformin in Lebanon. Since Normalizing vitamin B 12 levels is important to decrease serious consequences such as: megaloblastic anemia, myelopathy and neuropathy which can be misdiagnosed as long-term diabetes complications. Also, the pharmacist counseling have a crucial impact in improving the perception about disease, diet, and lifestyle changes, metformin use & monitoring thus improve the overall glycemic control. Finally, insignificant relationship between metformin dose and duration of use requiring further studies to determine the real association.

Category: Chronic / Managed Care

Title: Diabetic foot ulceration: inpatient relevant risk factors

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Purpose: Foot ulcers are one of the most common complications of diabetes mellitus worldwide. According to American Diabetes Association (ADA), diabetic foot disease can be attributed to several risk factors. The purpose of this study was to evaluate whether Lebanese diabetic patients with ulcerations, admitted into two hospitals in Beirut, Lebanon, have the same risk factors based on guidelines and review articles.

Methods: This was a multicenter, retrospective, and observational study conducted from February till May 2012. Every person who presented with a history of diabetes and has diabetic foot ulceration was enrolled in the study. Patients with a history of ulceration with no diabetes mellitus, and cancer were excluded. The primary outcome was evaluation of risk factors that lead to diabetic foot ulceration with universal guidelines. The secondary outcome was assessment of the main risk factors leading to hospital admission among these patients. The information gathered included patient's demographics, social history, laboratory findings, past medical history, medications, diabetes complications and presence of infection. The study was approved by the Institutional Review Board (IRB) in each hospital. Statistical analysis was done using Statistical Package for the Social Science (SPSS). Data were reported as mean (SD) or as absolute numbers (percentages). Identification of risk factors associated with diabetic foot characteristics was done by univariate and multivariate logistic regression analysis.

Results: Total number of 2090 patients was screened and 150 patients were enrolled. Patients who developed foot ulcers were mainly males (74.7%) with old age (62.811), long duration of diabetes (16.58.7), hypertension, previous ulceration, poor glycemic control (HbA1c=10.142.04), on oral hypoglycemic agents (70%) and non- satisfactory economic status (62%). Neuropathy and peripheral vascular disease were present in 77.3% and 68.7% of patients respectively ($p < 0.001$). Logistic regressions were done to show that the presence of previous ulceration ($p=0.05$; OR=2.398; 95% CI= 1.000-5.747) was the only significant predictor for peripheral vascular disease while gender (being a male) ($p=0.048$; OR=0.399; 95% CI=0.161-0.991), economic status (non- satisfactory) ($p=0.049$; OR=0.173-0.998; 95% CI=0.173-0.998), and duration (>10 years) ($p=0.014$; OR=2.898; 95% CI=1.245-6.756) were significantly associated with neuropathy. Furthermore, the average hospitalization days was around 16.9 where the presence of previous ulceration ($p=0.027$), neuropathy ($p=0.02$), and previous amputation ($p=0.001$) were significantly associated with hospitalization.

Conclusion: The study shows that the presence of risk factors leading to diabetic foot ulceration among Lebanese population is compatible with the guidelines. Neuropathy and peripheral vascular disease play an important role in the development of these ulcerations. Other risk factors that have a significant association are previous ulceration, gender, old age, longer diabetes duration, hypertension, poor glycemic control, oral hypoglycemic agents, and non-satisfactory economic status. The presence and combination of these factors contribute to hospital admission and increase hospital stay. Health care professionals should provide medical counseling to diabetic patients to prevent foot ulceration development and decrease hospital admissions.

Category: Chronic / Managed Care

Title: Analysis of clinical pharmacist impact on low density lipoprotein cholesterol values in patients with cardiovascular disease through a live, primary care-based intervention program

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Purpose: Pharmacist-based medication therapy management (MTM) chart-review services are commonplace in many accountable care organizations, primary care clinics, and managed care companies. They have proven to have a positive impact on patient outcomes and goal attainment. However, there are minimal data evaluating the effectiveness of live MTM services or comparing this type of service to the standard MTM chart-review. The purpose of this study is to determine the impact of a live clinical pharmacist (CP) intervention program on mean low density lipoprotein (LDL) reduction from baseline in patients with cardiovascular disease (CVD) when compared to standard, remote CP chart-review MTM services.

Methods: The institutional review board approved this prospective, multicenter, observational study. Patients were included if they had CVD and an LDL greater than 120 mg/dL within 12 months of their upcoming clinic appointment. Patients were excluded if no LDL value was reported within 6 months following the appointment. This live MTM pilot program involved one-on-one pharmacist-clinician meetings. Only data from CPs involved with both programs was collected, allowing them to serve as their own controls. Fifty participants per group would allow detection of statistical significance at the 5 percent level with 80 percent power; eighty patients were included in each group. A mean LDL reduction within each group of 40 mg/dL or more for the chart-review MTM and 60 mg/dL or more for the live MTM would be deemed statistically significant. This difference of 20 mg/dL in mean LDL reduction between groups would also be deemed statistically significant. Primary outcomes included mean LDL reduction within 6 months of baseline, number of patients achieving LDL goal, and the percent of accepted CP recommendations. The secondary outcome revealed the types of CP recommendations. A sub-analysis of the same endpoints was completed for patients whose CP recommendations were ultimately accepted.

Results: The mean LDL reduction from baseline in the chart-review MTM group and the live MTM group was 36 mg/dL plus or minus 23.2 mg/dL (P equals 0.001) and 62 mg/dL plus or minus 28.3 mg/dL (P equals 0.001), respectively. The difference between these two groups was deemed statistically significant (P equals 0.001). The chart-review MTM group had 30 percent of patients reaching their LDL goal with 66.3 percent of CP recommendations being implemented while the live MTM group had 51.3 percent of patients reaching their LDL goal with 86.3 percent of recommendations implemented (P equals 0.006 and P equals 0.003, respectively). The sub-analysis showed consistent results related to mean LDL reduction within and between

groups (P equals 0.001) but it failed to reach statistical significance in regards to the amount of patients reaching their LDL goal (P equals 0.079). The majority of CP recommendations were related to statin potency change (dose, agent, or both). Baseline characteristics were similar between both study groups.

Conclusion: Live, one-on-one pharmacist-clinician MTM provides a significantly higher mean LDL reduction from baseline compared to chart-review MTM. There was also a significant mean LDL reduction from baseline within each group which shows that both types of MTM services provide favorable patient outcomes. Live MTM is associated with a significantly higher CP recommendation acceptance rate and amount of patients reaching their LDL goal. Reductions in LDL remained consistent in the subgroup analysis which consisted solely of patients with accepted CP recommendations. Future studies should interpret additional disease state markers as well as cost analyses over a longer time period.

3-046

Category: Clinical Service Management

Title: Kaiser Permanente Colorado (KPCO) Home Infusion Pharmacy (HIP) Services: A Description of a Lean Six Sigma Process Improvement Project

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Purpose: The KPCO HIP service relied on multiple operational workflows that were manual, inefficient and inconsistent. Clinical pharmacists were engaged in activities that were not within scope of their role, feedback from patient care teams identified a lack of clinical documentation in the electronic medical record (EMR), and multiple systems were used to support daily operations. This project was designed to identify and implement workflow changes for refill prescriptions that support right people doing the right work; streamline workflows for clinical pharmacists and technicians for refill prescription orders; increase the use of EMR tools; and increase EMR clinical documentation.

Methods: In September 2010, HIP partnered with the Pharmacy Strategy & Optimization team to employ Lean Six Sigma (LSS) process improvement tools to define, measure, analyze, implement, and control solutions to enhance performance and sustain operations. Observations of clinical pharmacist and technician workflows for new and refill prescriptions were completed to identify inefficient and inconsistent steps. Timings of workflow steps was completed to capture touch time, time spent on a workflow step, and cycle time, time between workflow steps in which no work is being completed.

Results: The implementation of streamlined workflows that prioritized and eliminated duplication of tasks resulted in the clinical pharmacists and technicians engaged in the right work at the right time. Total clinical pharmacist touch time for refill prescriptions decreased by 62 minutes (from 77 to 15 minutes) per prescription. Clinical pharmacist cycle time was decreased by 70 minutes (from 83 to 13 minutes) per prescription refill. Total technician touch time decreased by 29 minutes (from 39 to 10 minutes) per prescription refill. Technician cycle time also decreased 29 minutes (from 33 to 4 minutes) per prescription refill. At baseline, patient consults and EMR documentation were inconsistent and/or incomplete. Implementation of enhanced workflows resulted in 100% patient consultation and EMR documentation within 24 hours of start of care and has been consistently sustained. By working proactively, need for urgent home delivery of therapy was reduced from 52% to 10% and approximately \$23,000 in costs was avoided over the 9 month workflow enhancement time period. As a result of these

improvements the HIP service was expanded to a 7 day operation in October 2012. This expansion will help to avoid a projected cost of \$58,400 per year in overtime expenses.

Conclusion: The workflow enhancements contributed to efficient and consistent delivery of quality to members. The LSS process methodology used can be adopted in other community infusion pharmacies. The approach used in this project is innovative, as the traditional method of jumping to a solution to quickly implement was challenged. A daily scorecard provided an innovative method to monitor performance and sustainability of workflows. These workflows have been sustained since implementation in January 2011. The methods used in this project are currently being utilized in process improvement initiatives in other KPCO Oncology Pharmacies.

Category: Clinical Service Management

Title: Impact of statins on blood glucose levels in Lebanese type two diabetic patients

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Purpose: Diabetes is a coronary heart disease (CHD) risk equivalent associated with high cardiovascular events. Atherosclerosis-related events account for approximately 65% to 75% of all deaths in people with diabetes. Therefore, aggressive treatment of lipid abnormalities with statins as primary treatment has generally been adopted as a standard of care in diabetic patients. The US Food and Drug Administration have recently issued a warning that statins may increase the risk of new-onset diabetes and worsen glycemic control in diabetic patients. This study is designed to assess the effect of statin types and doses on blood glucose levels and evaluate the clinical implication of this association.

Methods: The institutional review board approved this retrospective study which was conducted at two Lebanese hospitals from February till May 2013. Type II diabetic males and females were enrolled if they were on statins for at least one year. Patients taking medications or with diseases that affect blood glucose were excluded from the study. Patients medical records were screened to check for the demographic information, present and past medical and medication histories. The following parameters statin type, dose, and duration were recorded and documented on the questionnaire. The fasting blood glucose levels, creatinine, body mass index (BMI), and lipid profiles were assessed. Data were coded and analyzed using statistical Software Package for Social Sciences (SPSS). Analysis of Variance (ANOVA) was used to evaluate the association between statins and fasting blood glucose levels. The outcome measure was to assess the effect of the different statins at different doses on the mean fasting blood glucose levels.

Results: A total of 1500 patients were screened and 131 included in the study. The age of all enrolled participants (mean \pm -standard deviation) was 63.34 \pm 11.43 years, and BMI of 27.44 \pm 7.61 Kg/m². From the participants, 54% were on Atorvastatin 20 mg, 16% on Atorvastatin 40 mg, 10% on Rosuvastatin 10 mg, 8% on Simvastatin 20 mg, 7% on Atorvastatin 10 mg, and 5% on Rosuvastatin 20 mg. The mean fasting blood glucose levels were 183.16 mg/dL Atorvastatin 20 mg, 189.11 mg/dL Atorvastatin 40 mg, 202.05 mg/dL Rosuvastatin 10 mg, 174.64 mg/dL Simvastatin 20 mg, 175.81 mg/dL Atorvastatin 10 mg, and 169.5 mg/dL Rosuvastatin 20 mg. The association between statins at the different doses and mean fasting blood glucose levels was not statistically significant ($p=0.949$).

Conclusion: In view of the evidence, it is difficult to refute that an association exists between statin use and diabetes. From a clinical standpoint, there is currently no evidence that elevations in blood glucose while taking statins attenuate the beneficial effects of the therapy. Statins should continue to be used based on a careful assessment of risk and benefit.

3-048

Category: Clinical Service Management

Title: Prospective study to evaluate impact of direct pharmacist care on clinical outcomes of heart failure patients in a collaborative care setting

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Purpose: Heart failure is a major cardiovascular syndrome that affects approximately 5.7 million people in the United States. Due to their expertise in drug therapy, pharmacists are well qualified to provide the necessary medication education to patients to improve medication adherence. In addition, with the recent signing of the collaborative drug therapy management legislature in New York State, pharmacists now have the opportunity to directly influence patient outcomes. The purpose of this study is to determine if direct patient care provided by pharmacists within a collaborative care environment could have a positive impact on the outcomes of heart failure patients.

Methods: This is a prospective quality improvement study aiming to evaluate the clinical impact of direct pharmacist care on heart failure patients within a collaborative care clinic. Patients with a diagnosis of heart failure or a left ventricular ejection fraction (LVEF) of less than 40 percent who were admitted to our medical center or visited our medical clinics are eligible for this study. All patients received a one hour pharmacist consultation on their disease states and medical therapies. In addition, medication reconciliation as well as initiation and up-titration of drug therapies as per physician-pharmacist collaborative agreement were performed. The primary outcome measure is the 30-day readmission rate compared to the average reported value. Secondary outcomes include 1) 90-day readmission rate compared to baseline; 2) change in the Kansas City Cardiomyopathy Questionnaire (KCCQ) scores from baseline to 6 months after the clinic visit; 3) proportion of patients who received optimization of their heart failure therapy regimen at the clinic visit.

Results: From March 2012 to May 2013, 57 patients were seen by pharmacists at the clinic. Of these patients, 7 had a LVEF of greater than 55 percent and no documentation of heart failure in the medical record and were therefore excluded from our analysis. Of the remaining 50 patients, 4 patients were readmitted to the hospital within 30 days after our pharmacist consultation which represents an 8 percent 30-day readmission rate. This percentage of readmission is 3-fold lower than the average 30-day readmission rate of 24 percent reported in the literature. Thirty-six patients were included for the 90-day readmission analysis; 18 patients had at least one admission to the hospital related to heart failure in the 90 days prior to and no readmissions to

the hospital in the 90 days after our clinic visit. Ten out of 22 eligible patients were successfully contacted for a six-month follow-up KCCQ evaluation. The average KCCQ score for 10 patients has improved from 64 to 81. Of the 50 heart failure patients seen at the clinic, new medications required to manage heart failure or hypertension were initiated in 19 patients and titration of heart failure medications towards optimal doses were performed in 24 patients.

Conclusion: The relatively low 30-day readmission rate for heart failure patients in our study suggests that direct pharmacist care have a vital role in reducing hospital readmission rates. This study also confirms the positive value of collaborative drug therapy management in improving the functional status and quality of life of heart failure patients.

Category: Clinical Service Management

Title: Impact of a decentralized integrated pharmacist staffing model on pharmacist initiated interventions

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Purpose: A pharmacy department in a community hospital developed a business plan with the purpose of increasing clinical services. Implementation of the business plan led to a pharmacist practice model change from a centralized, drug distribution centered model to a decentralized, patient centered integrated model. The purpose of this project was to identify the impact of changing staffing models on pharmacist initiated interventions.

Methods: Pharmacist initiated interventions were collected 9 months pre and post implementation of the decentralized, patient centered integrated model. All pharmacist interventions were included except those resulting from a consult service or those considered dispensing duties. Excluded interventions were pharmacokinetic dosing and interventions that clarified doses, allergies, and therapeutic duplications. Interventions were collected from pharmacy information system intervention reports and paper intervention reports. The total number of interventions was collected from December 2011 to August 2012 and September 2012 to May 2013 in order to calculate a monthly average before and after the change in practice model. Interventions were also categorized to evaluate the impact on the types of interventions. Categories for classification of interventions included: anticoagulant, antimicrobial, intravenous to oral conversions, and other. Statistical analysis for the change in the number of interventions was evaluated through a paired t test. Data are expressed as means with 95 percent confidence intervals.

Results: The total number of pharmacist initiated interventions pre and post implementation of the decentralized, patient centered integrated model increased from 1281 to 3563, a difference of 2282 interventions (95 percent CI, 155.85 to 351.26, P less than 0.001). Average monthly interventions increased approximately 179 percent from 142 to 396 interventions. The total number of anticoagulant interventions increased from 46 to 200 during the same time frame (95 percent CI, 8.78 to 25.45, P equals 0.001). Significant improvement was demonstrated in the number of antimicrobial interventions which changed from 1049 to 2410 after decentralization (95 percent CI, 83.81 to 218.63, P less than 0.001). Intravenous to oral conversions increased from 186 to 392 after decentralization (95 percent CI, 4.87 to 40.91, P equals 0.019). All other pharmacist initiated interventions increased with 0 reported pre implementation and 561

interventions reported after the practice model change (95 percent CI, 42.36 to 82.31, P less than 0.001).

Conclusion: Changing from a centralized, drug distribution centered to a decentralized, patient centered integrated model increased the number of pharmacist initiated interventions in a community hospital.

3-050

Category: Clinical Service Management

Title: Implementation of a pharmacist based education program to reduce congestive heart failure readmissions in a community hospital

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Purpose: To develop a pharmacist based educational program for CHF patients as part of the transition of care, with the ultimate goal to reduce CHF hospital readmissions while improving patient care.

Methods: A prospective study was designed to compare CHF readmissions rates before and after a pharmacist intervened while developing an educational program. A list of Medicare patients over 65 years old with a diagnosis or history of CHF is reviewed daily. Each patient receives a visit from the pharmacist where home and current hospital medications are discussed. A CHF multidisciplinary team was established to discuss coordination of care and discharge planning. The pharmacist rounds with the team to discuss medications concerns. During the admission, pharmacist interventions such as core measure fulfillment and medication reconciliations are recorded. Upon discharge the pharmacist meets with the patient again to provide discharge medication counseling. Post-discharge, patients are encouraged to call the clinical pharmacist for medication related questions.

Results: A total of 32 CHF patients were monitored from December 2012 to March 2013. There were 17 patients coded as CHF and 3 were readmitted within 30 days. The readmission rate during the study period was 17.6%. A clinical pharmacist provided counseling to 26 patients and 41 interventions were recorded, with an acceptance rate of 70%. Compared to the previous years readmission rate of 21%, the addition of the pharmacist helped to decrease the CHF readmission rate by 3.4%.

Conclusion: The implementation of a pharmacist based CHF educational program was a success. Inclusion of a pharmacist in the transition of care decreased readmission rates by 3.4%, with an estimated cost savings of \$4,200. Due to the impact on readmissions and improved care, pneumonia patients are currently being included in the program.

Category: Critical Care

Title: Planning for and working in a new hospital facility: assessment of emergency response medication, equipment and resource needs

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Purpose: Optimal in-hospital emergency response requires strategically placed equipment, medication and supplies as well as strong supportive processes to maintain the system as designed. When moving to a newly built facility of entirely different layout, careful consideration of a multitude of factors must be assessed, such as physical lay out, personnel travel routes, signage, medication distribution systems, and equipment and supply availability. This report describes the detailed process undertaken by the pharmacist-led Resuscitation Committee at a 250-bed community hospital.

Methods: A multidisciplinary team utilized several methods to predict the emergency response needs in the new facility. A study of the architectural layout and of personnel flow through the building during response was performed to determine the need for, placement of and process of maintaining equipment and supplies. Timed trials were performed to assess the response time of each team member from various likely starting locations and to identify potential barriers. This information would be used to determine if more than one team assignment or division of the facility into zones was required. All equipment and medications in and on code carts and in various kits, equipment location and associated restocking processes were re-evaluated based upon the new workflow for the building. This included assessment of the content and stocking of the medication trays within the code carts and rapid response kits given a significant change in drug distribution system between the existing and new facility. A plan for move day was developed to support emergency response and equipment at both facilities.

Results: Timed trials supported that the existing one-team model would provide a response time under two minutes. Significant emphasis was placed on staff as first responders supporting optimal basic life support measures. Security was assigned strategic positioning at staff elevators to facilitate team member navigation. Needs assessment resulted in an increase of 31 to 59 adult, 9 to 12 pediatric, and 3 to 6 neonatal code carts. Cart locations were designated using architectural drawings and facility walk-throughs. The medication distribution model change from a Pyxis-based to nurse server (cart fill placed in room) model with limited Pyxis support led to significant consideration of emergency medication availability. Pyxis inventory, re-designed to support emergencies and controlled substances only, was adjusted with consideration of unit-

specific and system-wide needs. Medication trays were adjusted with consideration of historical use patterns during various response types, planned Pyxis inventory, new pneumatic tubes and continued availability of 24/7 pharmacy services. Notably, controlled substances were removed from the code trays given their location in public access hallways and security by one break away lock. Pyxis inventory and kits brought to responses by anesthesiologists assured availability of appropriate agents for rapid sequence intubation or similar emergencies.

Conclusion: The planning process to assure seamless transition of emergency response for all populations in a new, very differently structured and operated facility required an intensive multidisciplinary assessment. Review of architectural drawings, walk through of the construction site, timed trials within the facility, educational training, and consideration of operational process changes (such as an entirely different drug distribution model) were required. This resulted in a significant increase in both deployed and exchange code carts and an intensive review of the smaller Pyxis inventory lists, with the most notable change being removal of controlled substances from the code trays.

3-052

Category: Critical Care

Title: Cost-effectiveness of Dexmedetomidine vs Midazolam or Propofol for Sedation for Mechanically Ventilated Patients in the Intensive Care Unit

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Purpose: Midazolam and propofol are the most commonly used sedative agents in the intensive care unit setting for patients on mechanical ventilation, but studies have suggested that dexmedetomidine may reduce both costs and complications of intubation associated with care in the ICU. The objective of this study is to assess the cost-effectiveness of using dexmedetomidine compared to midazolam and propofol for sedation in mechanically ventilated patients in the ICU requiring at least 24 hours of ventilation from a third party payer and hospital administrator perspective in the United States. All costs were adjusted to 2012 \$USD.

Methods: Two base-case analyses using Markov models were constructed to simulate a stay in the ICU on mechanical ventilation while being sedated with dexmedetomidine, midazolam, or propofol. The simulation was run for 30 days, at which point at least 90 percent of patients had been discharged or were dead. Base-case simulations were based on the Dexmedetomidine vs midazolam (MIDEX) or propofol (PRODEX) for sedation during prolonged mechanical ventilation randomized controlled trials. Time to extubation, time to ICU discharge, days in delirium experienced, days spent intubated, ICU length of stay, total cost associated with an ICU stay, costs of drugs, and cumulative mortality were all included.

Results: The median time to extubation was lowest in the dexmedetomidine arm in both the MIDEX-based (1.58 days shorter) and PRODEX-based (0.89 days shorter) simulations. Patients on dexmedetomidine, on average, spent 2.13 days and 1.35 fewer days in the ICU compared to midazolam and propofol, respectively. These shorter extubation times and lengths of stay resulted in lower cost, fewer days in the ICU, less days in delirium, and less time intubated across the board for the dexmedetomidine arms in addition to decreased mortality. The incremental cost-effectiveness ratios (ICER) were \$3,078, \$9,307, and \$3,319 respectively for averting a day in the ICU, averting a day of delirium, and averting a day of intubation in the MIDEX simulation. The respective ICERs in the PRODEX simulation were \$4,298, \$4,531, and \$4,313. In the MIDEX simulation, the dexmedetomidine arm had an end mortality of 36.0% while the midazolam arm had an end mortality of 44.0%. In the PRODEX simulation, the dexmedetomidine arm had an end mortality of 29.8% while the propofol arm had an end

mortality of 34.6%. Dexmedetomidine could provide the same probability of mortality as midazolam at a lower cost until the probability reached a 14.6% chance of dying (rate of approximately 3% was used in base case). Dexmedetomidine was less costly than propofol until the probability of dying was 20.9% or greater.

Conclusion: The use of dexmedetomidine in the ICU setting is a cost-effective modality from the perspective of the healthcare payer for decreasing rates of mortality, time spent intubated, incidence of delirium, and ICU length of stay.

3-053

Category: Drug Information

Title: Student Peer Review Training in Drug Information: Do Student Training and Incentives Make a Difference?

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Purpose: To measure the difference in outcome on the final project grade of a student literature research paper with formal student peer review, performed with and without the benefit of training and grade incentive.

Methods: For several years, PY1 students in a drug literature class have constructed a drug information question based on experiences in a patient care course. This question is approved by their patient supervising instructor and the course instructor prior to the research. The student then conducts a literature search and produces a formal written response using a systematic approach that includes the question, background information, response and references. These responses are graded with an established rubric. In 2011 students were asked to pair up (their choice of partner) and perform a peer review for each other prior to submission so that papers could be improved. This same process was repeated in 2012 except that in addition, a specific reading and one hour training was conducted on peer review, and a 10% point bonus was awarded for the peer review function. Cumulative final project grades from 2012 were compared to 2011 results and to 3 previous years without peer review. Also, the peer review grades were compared to the instructors grades.

Results: Comparisons of 2012 (148 students) data to 2011 (153 students) showed a difference in grades for the assignment, the instructor scores increased (88.9 vs. 85.8; therefore the papers were judged to be better) and the student reviewer scores decreased (92.8 vs. 96.8; therefore a more serious effort in student review).

Conclusion: Peer review is important for the pharmacist in many aspects of practice. This study shows the potential benefit of specific training as well as incentives in a drug literature project. This activity helps reinforce the concepts of peer review and assists in the greater understanding of the biomedical literature. It addresses critical thinking and some aspects of the publishing process; it also begins the process of analyzing clinical trial designs and applying the analysis to form a rational conclusion. This may help internalize peer review concepts for future practice and encourage postgraduate participation in the publishing process.

3-054

Category: Drug Information

Title: Identification of significant inaccuracies in commonly-used, online drug information compendia; one company's approach

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Purpose: Healthcare professionals (HCPs), such as pharmacists, physicians, and nurses, have access to multiple drug information references. Online compendia are readily-accessible, comparatively-easy to search, and are generally presumed to be accurate and current. While these resources clearly provide value to support decision-making, studies have identified significant inaccuracies, gaps in data, and outdated content. This motivated the need for periodic, standardized review of selected online compendia by Purdue Pharma L.P.'s Medical Services (medical information) department.

Methods: The online sources were identified through utilization-research statistics, studies evaluating use of drug-information compendia by HCPs (especially pharmacists), and familiarity of sources to Purdue Medical Services. While the monographs of some sources focused on drug substances and also included product-specific information, others solely focused on a particular branded drug product. Information in the selected online references on various Purdue products was reviewed and compared to current Full Prescribing Information (FPI). The main focus of each review was to identify inaccuracies that could cause harm to patients, such as incomplete, inaccurate, or outdated information. Additional inconsistencies that could impact pharmacists' decisions were also identified. Where significant deviations were discovered, corrections were requested.

Results: Errors (omitted or inaccurate information) in monographs on or including Purdue products were identified in majority of the compendia reviewed, although certain ones (eg, The Merck Manual, DailyMed) contained few (15) or no errors. Product monographs intended for use by HCPs, in particular those with a strong clinical focus, contained more errors compared than those intended for consumers. Examples of errors included: failure to provide full indication or limitations of use; inaccurate dosing and administration information; omission of some warnings, precautions, or contraindications; inaccurate adverse event information; omission of drug-drug interactions; incorrect product-specific pharmacokinetic data; inclusion of discontinued products, strengths, and dosage forms; and incomplete patient education materials. Deviations were discovered frequently enough that a templated table for identifying the incorrect information, suggesting accurate replacement language, and providing evidence supporting the

request was created to communicate correction requests. The language of the product monograph based on the intended audience (HCPs or consumers) was considered when requesting corrections. Correction requests underwent thorough internal review prior to sending to compendia editors. Content updates occurred in few compendia following notification of erroneous drug information. The number of errors eventually corrected, as well as the time to correction, differed widely amongst compendia.

Conclusion: Readily accessible drug information compendia are valuable resources to HCPs in all settings and facilitate retrieval of immediate information desired or required for making treatment decisions. However, for online compendia to adequately support appropriate clinical practice and patient safety, it is imperative that they routinely review and update their drug information and respond quickly to evidence-based requests for corrections. It is in the interest of pharmaceutical manufacturers to proactively review and notify compendia when misinformation exists about their products or when there are relevant updates to a products FPI to ensure online, third-party product monographs are accurate, complete, and contemporary.

3-055

Category: Drug Information

Title: WWW what? Evaluation of medical information websites for healthcare professionals provided by the pharmaceutical and biopharmaceutical industry

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Purpose: Healthcare professionals may call a pharmaceutical company's contact center to obtain medical information about their products. Coordinating a healthcare professional's available time with a call center's operation hours may be difficult, causing a delay in the retrieval of information. Healthcare professional medical information websites provided by companies offer an alternative method for retrieving information at any time. This study identified the top pharmaceutical and biopharmaceutical companies that maintain medical information websites for healthcare professionals, and evaluated various website features that are required to obtain desired information.

Methods: This was a prospective observational study. Evaluation of selected medical information websites provided by pharmaceutical and biopharmaceutical companies was completed with a standardized rubric. The rubric included functions and resources that may be required for a healthcare professional to successfully retrieve medical information: access, communication channels, search capabilities, search results, additional resources, and the availability of a corresponding mobile application. The top twenty pharmaceutical and top ten biopharmaceutical companies by revenue in the United States that supported prescription drug products and had a healthcare professional medical information website were included. General company or product healthcare professional websites and nonprescription product companies were excluded. This study was exempt from Institutional Review Board approval.

Results: Healthcare professional medical information websites were provided by 7 out of 20 (35 percent) pharmaceutical and 6 out of 10 (60 percent) biopharmaceutical companies (N equals 13). Nine websites were found on a company homepage, product specific healthcare professional website, or company healthcare professional website; four were identified through an independent internet search. Registration or general sign in was required by 10 (76.9 percent) websites, and a professional license number was required by 5 (38 percent). All websites provided a search toolbar, where 11 (84.6 percent) allowed a general keyword search and 2 (15.4 percent) required a specific search. All websites accepted information requests, where 10 (76.9 percent) asked for a preferred method of delivery. Access to standardized response documents was provided by 10 (77 percent) websites: All were formatted as a portable document format (PDF) file and 2 out of 10 (20 percent) were provided as both a PDF and a webpage. Seven (53.8 percent) provided direct links to additional sources of information. A corresponding mobile application was available for 3 (23 percent) of the websites.

Conclusion: Pharmaceutical and biopharmaceutical companies provide medical information websites independent from branded drug websites. Thirteen websites from thirty companies were identified and evaluated. This study was limited by the number of companies included and the process for locating the websites, as some may have been overlooked. The rubric was not a validated tool. Additionally, the focus of this research was to identify general functions and resources provided, rather than the quality of the information. Pertinent medical information can be accessed without delay from these websites and used concurrently with standard literature retrieval practices.

Category: Drug-Use Evaluation

Title: Drug use evaluation of ceftriaxone in a tertiary academic hospital in Qatar

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Purpose: Ceftriaxone possesses a broad spectrum antimicrobial activity. Inappropriate use of this medication has led to increasing rates of bacterial resistance which may reflect an increase in healthcare cost. In our facility it is unclear if the use of ceftriaxone is appropriate, according to our evidence-based assessment criteria. The aim is to evaluate the use of ceftriaxone at Hamad General Hospital (HGH), a 600 bed tertiary care teaching hospital.

Methods: We prospectively conducted a descriptive, cross-sectional drug use evaluation (DUE) on adult patients over a 10-day period. The appropriateness was assessed regarding indication, dose and duration based on HGH protocol and international antimicrobial guidelines by two independent clinical pharmacists. The continuity of ceftriaxone versus culture sensitivity results were also further assessed. Drug use was considered inappropriate when it did not match the proper indication, culture results or duration.

Results: A total of 45 patients were included. Ceftriaxone was mostly used in medical and surgical wards (64.4 percent) compared to emergency department and intensive care units (35.5 percent). Ceftriaxone was prescribed empirically in 71.1 percent, prophylactic in 24.4 percent and directed in 4.4 percent of the patients. In total, the prescribing pattern was appropriate in 56.8 percent of the patients. Inappropriate prescribing mostly lied in the prophylaxis group (70 percent) versus 61 percent in empiric therapy. Most of the inappropriate use was being given as one dose in the emergency department and discontinued later or switched to another antimicrobial. Ceftriaxone continued in 38 percent of patients with negative culture. Also, bacterial eradication could not be evaluated in 15.6 percent of the patients as they did not have a culture and sensitivity order. Those patients usually had Intra-abdominal and bone infections. The dose of 2 gram once daily, 2 grams twice daily and one gram once daily were given to 88.9, 6.6 and 4.4 percent of the patients, respectively. The mean length of stay was 5.6 plus/minus 3 days while the average duration of treatment was 5 days. About 37.2 percent of patients were receiving other antimicrobial agents concurrently.

Conclusion: There is a high percentage of inappropriate ceftriaxone prescribing especially under prophylaxis criteria. It was found that ceftriaxone was being given in the emergency department as one dose and discontinued afterwards. Therefore, measures should be taken to improve the appropriateness of prescribing and adherence to infectious diseases guidelines. Furthermore, study evaluating cost effectiveness of 1 gram versus 2 grams is warranted because of much utilization of 2 gram-dose. The need for ordering culture and sensitivity should be emphasized prior treatment initiation as part of standards of quality.

3-057

Category: Drug-Use Evaluation

Title: Analysis of conversion of glyburide to glipizide for safety and effectiveness in a veteran population

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Purpose: Sulfonylurea medications are second line agents in diabetes mellitus patients and commonly used in the veteran population. Glyburide has an increased risk of hypoglycemia, especially in elderly patients with renal insufficiency. In July 2009, the Pharmacy Benefits Management Services recommended patients with renal insufficiency or decreased renal function due to age avoid glyburide and utilize an alternative sulfonylurea. In November 2012, the pharmacy and therapeutics committee recommended switching all patients on glyburide to glipizide despite renal function and age. The purpose of this medication use evaluation was to analyze the safety and effectiveness of the conversion of glyburide to glipizide.

Methods: The Pharmacy and Therapeutics Committee approved this retrospective chart review. Patients were included in this review if they had an active prescription for glyburide in November 2012. The computerized medical record was reviewed for safety data which included hospitalization or urgent care visits for hypoglycemia or hyperglycemia after conversion and adverse drug reaction (ADR) rate. Efficacy data gathered included glyburide and glipizide dose at conversion, current glipizide dose, hemoglobin A1c (Hgb A1c) prior to conversion, Hgb A1c 3-6 months later and if any new anti-diabetic agents were started. The milligram to milligram conversion was either a glyburide to glipizide conversion of 1 to 2 or 1 to 1 based on provider preference.

Results: One hundred fifty one patients had an active prescription for glyburide in November 2012 of which 49 percent were converted. One patient moved from the area. No patients were seen in urgent care or hospitalized for hyperglycemia or hypoglycemia after the conversion. The percentage of those with an adverse drug reaction (ADR) to glipizide before and after the conversion was 5.2 and 5.4 respectively. Dose conversion was 1 to 2; 1 to 1; increased or decreased in 83.8 percent, 12.2 percent, 2.7 percent and 1.3 percent respectively. Mean change in Hgb A1c for those groups respectively was an increase of 0.12, an increase of 0.25, an increase of 1 and a decrease of 0.15. Of the 74 converted, 32 had a Hgb a1c drawn 3-6 months after the conversion. Of those, 18 Hgb A1c increased; 13 decreased and 1 remained the same. The average baseline Hgb A1c before and after conversion was 7.31 and 7.71 respectively, reflecting a blood glucose increase of approximately 11.5 mg/dL. The average Hgb A1c increase was 0.68 while the average decrease was 0.61. Ten of the 151 patients were started on a new drug for diabetes mellitus, of which 5 were started on insulin.

Conclusion: Since the glyburide to glipizide conversion was optional, only 49 percent of patients were converted. Data available from the 74 patients converted shows the conversion was safe and the adverse drug reaction percentage was comparable. Based on these results, recommendations to the Pharmacy and Therapeutics Committee are to require conversion to glipizide in appropriate patients and to recommend repeating the Hgb A1c. In addition, dose conversions should be individualized based on patient parameters. Further studies will need to be completed to evaluate the effectiveness of glipizide versus glyburide.

3-058

Category: Drug-Use Evaluation

Title: Ondansetron in pregnancy induced nausea and vomiting: a medication use evaluation

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Purpose: Ondansetron is an antiemetic approved for short-term prevention of chemotherapy, radiotherapy and surgery induced nausea and vomiting. Post-market case reports have revealed risk of QT prolongation and torsades de pointes arrhythmias with ondansetron use, especially in patients with congenital QT prolongation or taking QT prolonging agents prompting an FDA warning. Despite safety concerns, limited long term safety data and lack of endorsement by the American College of Obstetricians and Gynecologists (ACOG), many providers prescribe ondansetron off-label for pregnancy induced nausea and vomiting. The purpose of this medication use evaluation was to investigate how widespread this issue was within our institution.

Methods: All ondansetron prescriptions written by our providers between 1/1/2012 and 9/30/2012 were analyzed. Prescriptions written for pregnancy induced nausea and vomiting were analyzed for safety of dose, duration and potential drug interactions. Indication was also analyzed, specifically whether the medication was used for nausea, vomiting or a more severe condition known as hyperemesis gravidarum which can cause marked dehydration and even electrolyte abnormalities. Patient medication histories were analyzed to determine whether potentially safer alternatives were tried before ondansetron.

Results: Of 64 prescriptions written for ondansetron during this period, 16 were for pregnancy induced nausea and vomiting. Of those, 81% were written for the first trimester when nausea and vomiting are typically the most severe. The most common dose was 8mg every eight hours. Average duration of therapy was 23 days excluding one outlier that was for the entire pregnancy. Only 12.5% of prescriptions analyzed were for hyperemesis gravidarum. In no case were alternatives such as pyridoxine or antihistamines tried before ondansetron. Ondansetron was used with another QT prolonging agent, namely citalopram, in one case or 6.25% of prescriptions analyzed.

Conclusion: In many cases, prescribers did not follow leading national guidelines when treating pregnancy induced nausea and vomiting. Medications generally recognized as safe and effective in this condition such as pyridoxine and antihistamines were bypassed and ondansetron was used first-line. Limited data exist on safety in long term use and in pregnancy and therefore excessive use of ondansetron puts patients at unnecessary risk. Results of this MUE were discussed at a Pharmacy and Therapeutics committee meeting and a prescribers' letter was distributed to clinic

providers addressing the issue. Pharmacy will conduct similar MUEs periodically to assess the effectiveness of these steps.

Category: Drug-Use Evaluation

Title: Evaluation of clinical and economic outcomes with alvimopan use in a community based hospital

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Purpose: Delayed gastrointestinal (GI) recovery post bowel resection surgery may be associated with increased hospital length of stay and institutional costs. In published clinical trials, alvimopan use has been associated with accelerated gastrointestinal recovery post bowel resection surgery. The purpose of this retrospective study was to determine and evaluate the clinical and economic outcomes for the use of alvimopan in this patient population at a single community based hospital.

Methods: The institutional review board approved this retrospective, non-matched cohort group study. Inclusion criteria were adult patients > 18 years of age, who underwent bowel resection surgery with either open or laparoscopic technique as defined by DRG codes (330, 331) and ICD-9 diagnosis codes, during the study period of October 1, 2011 through September 30, 2012. Exclusion criteria included; death by any cause, transfer to an outside acute care institution, trauma patients, patients who only received a single pre-operative dose of alvimopan, and a surgical procedure of ostomy without bowel resection. A total of 116 patients were included in this 12 month retrospective analysis. Included patients were placed in one of two groups, alvimopan group (n=78) and non-alvimopan control group (n=38), based on the prescribing of the intervention drug. Outcome measures included; length of stay, time to GI recovery, incidence of parenteral nutrition, total hospital costs, and pharmacy drug costs. GI recovery was defined in the study as tolerating solid foods and having a bowel movement.

Results: Each of the two treatment groups had similar baseline characteristics with regard to mean age, DRG codes, and surgical approach. There were, however, a statistically greater percent of female patients in the non-alvimopan control group. The mean length of stay (5.9 days vs 9.6 days) was lower for the alvimopan group than the control group ($P = 0.001$). Achieving a post-op LOS < 5 days occurred in 34 of 78 patients (43.6%) in the alvimopan group and 3 of 38 patients (7.9%) in the control group ($P = < 0.001$). The mean time to GI recovery (124.8 hours vs 167.4 hours) was lower for the alvimopan group than the control group ($P = 0.006$). The difference in percent of patients receiving parenteral nutrition (15.4% vs 23.7%) was not statistically different between the two treatment groups. The difference in mean total hospital costs (\$17,429 vs \$20,959) and mean pharmacy drug costs (\$957 vs \$703) were not statistically different for the two treatment groups ($P = 0.057$, $P = 0.06$).

Conclusion: The utilization of alvimopan in large or small bowel resection surgeries did improve clinical outcomes related to patient GI recovery and length of stay, while not showing a statistical difference in pharmacy or hospital costs. The pharmacoeconomic impact of this adjuvant therapy should continue to be studied in larger trials.

3-060

Category: Drug-Use Evaluation

Title: Evaluation of cost savings associated with implementation of ideal body weight (IBW) dosing of immune globulin, intravenous (human) (IVIG) at a community hospital

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Purpose: Utilizing IBW for dosing immune globulin has been implemented at various institutions to efficiently manage available supplies in a cost effective manner. The purpose of this study is to evaluate cost savings associated with IBW dosing for IVIG versus actual body weight dosing (ABW) in an in-patient setting.

Methods: This was a retrospective medication use evaluation (MUE) of IVIG use in a 200 bed community hospital. The MUE included patients that were selected from the pharmacy system database from January to December 2012 and had received an IVIG infusion. Patients were evaluated based on indication for IVIG, and heights & weights were recorded for each patient prior to infusion. IBW was then calculated using the BJ Devine formula, and BMI was also calculated. If the BMI was determined to be >30 , the dose for IVIG was calculated based on Adjusted Body Weight (Adj-BW). If the patient's ABW was below their IBW, the dose was calculated based on their ABW and it was not associated with any cost savings. The sum of the differences of IBW-dosing or Adj-BW-dosing from ABW-dosing for each infusion was utilized to determine the total annual cost saving. The cost savings were calculated based on an acquisition cost of \$47 per gram of IVIG.

Results: Fifteen (15) patients were evaluated and accounted for a total of 124 IVIG infusions. Ninety Four percent (117 IVIG infusions or 12 patients) of IVIG therapy were indicated for Idiopathic thrombocytopenia purpura (ITP) or an immunodeficiency. There were no patients found to have a BMI >30 , hence Adj-BW dosing was not utilized in the cost savings. Five patients or 49 IVIG infusions were not associated with any cost savings because these patients were either at, near, or below their IBW. Ten patients (75 IVIG infusion) were above their IBW by average of 14 kilograms. The average anticipated cost savings is approximately \$600 per each IVIG infusion. The annual anticipated cost saving of 950 grams of IVIG for our institution is approximately \$45,000.

Conclusion: Results demonstrate a significant potential cost savings for IVIG when dosing is based on IBW. Our institution will consider developing an automatic IVIG dosing protocol based on IBW. Further studies are required to evaluate any efficacy changes by using the new dosing regimen.

3-061

Category: Drug-Use Evaluation

Title: Inpatient admissions among schizophrenia patients before and after initiating a new atypical antipsychotic in a multi-state medicaid population

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Purpose: Schizophrenia is associated with high risk of relapse and inpatient admissions. Inpatient admissions are not only the most expensive component of schizophrenia treatment but also impact patient quality of life and increase caregiver burden. This analysis of multi-state Medicaid data aims to compare all-cause and mental health-related inpatient admissions among adult patients with schizophrenia 6-months before and after initiating lurasidone, a new atypical antipsychotic approved for treatment of schizophrenia in adults.

Methods: .Analysis of health insurance claims of patients with schizophrenia from the Truven Health MarketScan Multi-state Medicaid Databases was conducted. The study population included patients aged 18C64, who initiated lurasidone between 10/1/2010-9/30/2011 (initiation date=index), had 1 inpatient or 2 outpatient medical claims with an ICD-9-CM diagnosis code for schizophrenia and had continuous health benefit coverage during the study period. All-cause and mental health-related inpatient admissions associated with a primary diagnosis code for a mental health disorder were evaluated for the 6-months pre- and post-index date. Proportions of patients with hospitalizations and mean number of inpatient admissions were compared using chi-square and paired t-test, respectively.

Results: .The study population (N=152) was gender balanced (48% female) with a mean age of 43.4 years. The proportion of patients with all-cause inpatient admission decreased from 29.6% (pre-lurasidone initiation) period to 15.8% (post-lurasidone initiation) ($p = 0.0017$). Similarly, the proportion of patients with mental health-related inpatient admission decreased from 24.3% to 11.8% between the pre-and post-index periods ($p=0.0018$). The mean numbers of inpatient admissions in the pre- and post-index periods were 0.5 and 0.2 for all-cause ($p=0.0009$) and 0.4 and 0.2 for mental health-related conditions ($p=0.0040$).

Conclusion: .In this analysis of adult patients with schizophrenia, the rate of inpatient admissions for all-cause and mental health-related diagnoses declined by 50% in the 6 months after initiating lurasidone compared to the 6 months prior to lurasidone initiation.

Category: Drug-Use Evaluation

Title: Impact of delayed-dose administration of USL255, an extended-release topiramate formulation

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Purpose: When an antiepileptic drug (AED) administration is delayed, the risk of seizures may be increased. While extended-release (ER) formulations are likely to improve patient compliance compared with immediate-release AEDs, a delay in dose administration can cause steady-state (SS) plasma concentrations to drop below minimum therapeutic concentrations. USL255 is a once-daily (QD), ER formulation of topiramate (TPM) developed for the treatment of epilepsy. Simulations were performed to gain an understanding of the effects associated with delayed administration of USL255. The magnitude of change in maximum plasma concentration (C_{max}) and minimum plasma concentrations (C_{min}) after administration of the delayed dose was also assessed.

Methods: Data used for these analyses were obtained from a phase 1, single-dose study (N=36) that evaluated the PK profile of 200 mg USL255 administered in the fasted state to healthy volunteers. Nonparametric superpositioning was used to predict SS PK profiles from the single-dose data. Dose administration for 14 days was simulated to assure SS conditions were reached, followed by a simulated delay in dosing (6, 12, 18, and 24 hr later than scheduled), with QD dosing resuming after the late dose. For the 24 hr delay, two doses were assumed to be taken together. Mean-predicted concentrations were calculated for each delayed-dose scenario and were compared with SS concentrations without a delayed dose (full compliance). Simulated C_{min} and C_{max} were evaluated for up to 96 hr following the late dose.

Results: As expected, the mean-predicted plasma concentrations prior to the next scheduled dose decreased incrementally as the time delay increased. However, within one 24 hr dosing interval after the late dose was administered, the TPM concentration-time profiles for all 4 scenarios were similar by visual comparison to simulated SS concentrations with full compliance. Topiramate plasma concentrations were generally highest 2 days after a USL255 dose was administered 6, 12, 18, or 24 hr late; mean C_{max} values were 2.09%, 4.25%, 6.97%, and 11.85% higher than compliant dosing concentrations, and corresponding C_{min} values increased by 2.55%, 5.12%, 7.67%, and 10.23%, respectively. Three days after delayed-dose administration,

C_{max} values were 1.14 to 7.03% higher than concentrations without a delayed dose, and C_{min} values were 1.33 to 5.31% higher.

Conclusion: When a single dose of USL255 was simulated to be taken 6, 12, 18, or 24 hr later than scheduled, TPM plasma concentrations returned to near SS within one 24-hr dosing interval after the delayed dose was administered. These data demonstrate that administration of USL255, up to 18 hr after a missed dose, will minimize the duration of decreased TPM concentrations without significant risk of increased (>10%) maximal plasma concentrations.

Category: Drug-Use Evaluation

Title: Evaluation of post surgical antibiotic prophylaxis in a Lebanese hospital setting

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Purpose: 25% of all nosocomial infections are related to surgical wound infections, most of which are probably preventable by appropriate antibiotic prophylaxis. These infections increase health care cost by prolonging hospitalization stay, along with increasing morbidity and mortality. Guidelines for post surgical antibiotic prophylaxis are well established for the majority of procedures, however controversies regarding the choice of antibiotic and duration of treatment is encountered in different hospitals. The aim of our study is to evaluate the appropriateness of antibiotic prophylaxis after surgeries in different surgery types at a Lebanese hospital setting.

Methods: A direct observational method was used in this study to detect the adequateness of post operative antibiotic administration. 277 surgery patient charts were analyzed between July and December 2012. Surgery types were as follows: 22.0% gynecologic, 19.1% orthopedic, 15.5% urologic, 14.1% gastrointestinal, 13.7% otorhinolaryngologic, 7.9% ophthalmologic, 4.0% neurologic, and 3.7% plastic. The duration of the procedures ranged from 1 hour for ophthalmic operations up to a maximum of 6 hours in gastrointestinal, neurologic, orthopedic and plastic surgeries. The appropriateness of the choice of the antibiotic irrespective of the duration and the duration of prophylaxis irrespective of the antibiotic choice was performed. Furthermore, a supplementary comprehensive step concerning the conformity of the antibiotic and duration of prophylaxis was carried out.

Results: The choice of antibiotic prophylaxis was inappropriate in: 90% of plastic, 79.1% of urologic, 77.3% of ophthalmologic, 66.7% of gastrointestinal, 54.7% of orthopedic, 54.6% of neurologic, 50.8% of gynecologic, and 42.1% of otorhinolaryngologic procedures. As for the duration of the prophylaxis, it was not optimal in: 81.8% of neurologic, 53.5% of urologic, 48.7% of gastrointestinal, 39.7% of orthopedic, 29.5% of gynecologic, 10.5% of otorhinolaryngologic, 9.1% of ophthalmologic, and 3.0% of plastic surgeries. Of the total 277 procedures, antibiotic choice and treatment duration conformed with the guidelines in only 34.0% of the operations, as opposed to 31.0% which had a wrong regimen concerning the antibiotic and duration. The remainder 35.0% of the procedures had either the right agent or the length of treatment. Among the patients receiving the correct protocol, the otorhinolaryngologic population scored 57.9% of appropriateness as compared to plastic surgeries where only 10.0% received adequate therapy. 54.5% of the neurologic and 51.2% of the urologic procedures were inadequately prophylaxed after surgery concerning the drug choice and its duration. 34.5% of the

population who received an unsuitable regimen, had no treatment at all; whereas 35.5% of those who have received the wrong antibiotic, have been administered amoxicillin/clavulanic acid. Cefazolin remains the most common agent used for prophylaxis in our appropriate cases obeying the guidelines.

Conclusion: Prophylactic antibiotics have demonstrated a decreased risk of post-procedural infections and represent an important factor of the optimal management of patients undergoing surgery worldwide. The need of implementing strict guidelines in this institution is highly recommended in all types of surgeries requiring antibiotic prophylaxis. Our findings have shown unacceptable results. The medical doctors and pharmacists have a responsibility towards implementing a prompt strategy to correct the situation.

Category: Drug-Use Evaluation

Title: Evaluation of the use of a proton pump inhibitor in non intensive care units at a Lebanese hospital setting

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Purpose: According to the only available guideline published by the American Society of Health-System Pharmacists (ASHP) in 1999, the use of stress ulcer prophylaxis (SUP) is recommended in ICU patients. Recent data has shown that the inappropriate use of acid suppressive therapy in non intensive care unit (ICU) settings has been as high as 71%. Evidence of gastric mucosal damage in hospitalized patients has been the primary reason for the introduction of these agents to suppress acid secretion due to stress in inpatients. Regardless of this fact, the use of SUP in non-ICU settings is being abused. The aim of this study is to highlight the increasing and inappropriate practice of SUP in non-ICU settings at a Lebanese hospital.

Methods: A direct observational method was used in this study to detect the adequateness of SUP in non-ICU patients. 447 hospital medical charts from different hospital units (surgery, pediatrics, cardiology, and internal medicine) were evaluated for patients who were taking a proton pump inhibitor (PPI) over a duration of 14 months from February 2012 till March 2013. All patients included in this study were on Pantoprazole 40mg administered orally (3.8%) or intravenously (96.2%). 65.3% of the patients were on a once daily dosing, while the remainder of the patients received it as twice, three, or four times a day. Patients were analyzed to check for the duration of treatment, switch from IV to PO route, interventions of the pharmacist, gastrointestinal (GI) team approval, and risk factors that were suggested to support the use of pantoprazole. Data was analyzed using the SPSS program.

Results: The age ranged from 7-92 years old, whereby 63.8% were under 65 years and 36.2% were above that age. 224 (50.1%) were males and 223 (49.9%) were females. The duration of treatment ranged from 1 to 10 days, such that the majority of the patients (72.5%) received SUP for up to 3 days. 59.3% of the charts were not checked and approved by the GI team as compared to 40.7% who had their consent. Concerning the pharmacist input, 18 (4.0%) interventions were taken: two third (12 patients) had their treatment discontinued and one third (6 patients) had their regimens switched to PO. Among the patients who were receiving pantoprazole, 34.7% had either an ulcer, a GI bleed, or a documented helicobacter pylori infection. With regard to the risk factors that have been suggested to support the use of SUP, it has been noted that patients who had a prolonged surgery (34.0%) constituted the majority of users, followed by patients on

corticosteroids (29.1%), then patients on non-steroidal anti-inflammatory drugs (NSAIDs) (15.0%), and patients with hepatic and/or renal failure (7.2%). It is important to note that 2.9% of the patients had shock and/or sepsis.

Conclusion: The practice of SUP in Lebanese hospital centers is groundless, poorly documented and often depends on institution protocols. The use of unnecessary acid suppressive treatment can lead to various potential adverse drug events as well as an increase in medication costs for the patient and health care system. Pharmacists and physicians can play a crucial role in minimizing the improper use of SUP in non-ICU settings and providing optimal patient care by carefully analyzing the need for PPIs or other modalities. Thus it is essential to establish well documented and evidence based recommendations to dictate the appropriate practice of acid suppressive therapy. Moreover, the pharmacists input should be emphasized in order to achieve the best practice.

Category: Emergency Medicine / Emergency Room

Title: Drug utilization review of antibiotics in a Lebanese emergency department

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Purpose: Antimicrobial resistance remains a global concern, thus many institutions have published universal guidelines for healthcare professionals to limit the inappropriate use of antibiotics. Adherence to these guidelines is a cornerstone in the prevention of antibiotics resistance and improvement in the treatment outcomes. Antibiotics dispensed in emergency department (ED) are not always compatible with the guidelines. Therefore, this study is conducted to evaluate the compatibility between empirical antibiotics dispensed in ED as a treatment for certain infections and the universal guidelines.

Methods: This was a retrospective, single center study conducted from February till May 2013. Patient above 2 years of age admitted to ED, diagnosed with sepsis, pneumonia, skin and soft tissue infection (SSTI), urinary tract infection (UTI) and received antibiotics from January 2010 till December 2012 were enrolled in this study. Patients with hospital acquired pneumonia, ventilator associated pneumonia, complicated UTI, and intake of antibiotic one week prior to hospital admission were excluded from the study entry. The primary endpoint was the evaluation of the antibiotic compatibility dispensed in the ED with the universal guidelines. The secondary endpoint was the assessment of the major causes of the antibiotics misuse. Medical records reviews were performed using a data collection sheet. The Infectious Disease Society of America (IDSA) guideline was the reference for each infection. Statistical analysis done using statistical package for social sciences (SPSS) and data were expressed as percentages and proportions. The Institutional Review Board of the hospital reviewed and approved the study proposal.

Results: A total number of 2000 patients were screened and only 86 patients were enrolled in the study. Among the participants, 46 patients were diagnosed with pneumonia (54%), 20 with UTI (23%), 13 with sepsis (15%), and 7 with SSTI (8%). From the total number of infections, 57 cases (66.2%) were incompatible with the treatment guidelines. The percentages of incompatibilities were divided into 71.7% for pneumonia, 69.2% for sepsis, 60% for UTI, and 42.8% for SSTI. Potential causes of treatment incompatibilities were drug dose, duration, and selection which had the highest attributable effect. The percentage for inappropriate drug selection was 90% for pneumonia, 88% for sepsis, 58.3% for UTI, and 100% for SSTI.

Conclusion: The study shows that administration of antibiotics is incompatible with the guidelines in most of cases admitted to the hospital ED. Antibiotic therapy initially is prescribed

as an empiric treatment targeting the most suspected pathogens and tailored according to the isolated microorganism and its known susceptibility to antibiotics. The inappropriate use of antimicrobial agents is a major cause for acquiring resistance to many antibiotics. Clinical pharmacists play an integral role in minimizing the inappropriate use of antibiotics through continuous audit, and error documentation and implementation of quality improvement plans. Eventually, standards for proper drug prescriptions have been developed and distributed to all services at the hospital. Continuous education for all health-care professionals and encouragement of the adoption of the universal guidelines has been implemented.

Category: Emergency Medicine / Emergency Room

Title: Evaluation of the incidence of infusion-related errors associated with intravenous N-acetylcysteine for the treatment of acetaminophen toxicity

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Purpose: Hepatotoxicity secondary to acetaminophen overdose can be minimized through the use of intravenous n-acetylcysteine (IV N-AC). With the complex 21-hour dosing regimen of IV N-AC, consisting of varying doses and infusion rates, dosing and infusion-related errors may occur. In addition, the risk of infusion interruption exists, which may potentially lead to poor clinical outcomes. The primary endpoint of this study was to evaluate the frequency of infusion-related errors associated with IV N-AC for the treatment of acetaminophen overdose in acutely ill inpatients. The secondary endpoint was to determine if protocol deviations in the infusion had an impact on clinical outcomes.

Methods: The institutional review board approved this single-center cohort study, which entailed data collection through a retrospective chart review in patients who were hospitalized between June 2006 and May 2012. Patients were identified via a computer-generated synopsis of orders for IV N-AC infusion. Patients were included if between the ages of 21 and 89 years (inclusive) at the time of hospitalization and if IV N-AC was administered for suspected, acute, or chronic acetaminophen toxicity. Baseline characteristics related to patient age, weight, sex, type of ingestion, and time elapsed between ingestion and presentation were noted. Laboratory information collected included initial acetaminophen blood concentration, baseline aspartate aminotransferase (AST), alanine aminotransferase (ALT), and international normalized ratio (INR). The presence or absence of consultation with a representative from a poison control center or toxicology service was noted. Parameters related to processes of care that were analyzed included duration of infusion interruption; frequency of administration errors; adverse effects; and discharge status.

Results: A total of 93 patients were identified over the six-year study period. 86 (92.5%) patients presented with suspected, acute, or chronic toxicity, and 66 (71.0%) patients had ingested substances in addition to acetaminophen at the time of presentation. 79 administration errors were associated with IV N-AC infusion in 49 (52.7%) patients. The most common observed protocol deviations associated with IV N-AC infusion for acetaminophen toxicity were interruption of the infusion for greater than thirty minutes, which was observed in 32 cases; and deviation in the rate of the third dose by at least 10%, which occurred in 23 cases. The mean

duration of infusion interruption was 7.5 hours. Administration errors were not found to correlate with the incidence of hepatotoxicity or coagulopathy. However, administration errors were more likely to occur in those patients who received the infusion beyond 21 hours ($p = 0.0147$). In addition, protocol deviations in the infusion of IV N-AC were found to have an impact on length of stay, independent of the initial acetaminophen level, presence of co-ingestants, and discharge status ($p = 0.0227$).

Conclusion: Protocol deviations associated with IV N-AC for the management of acetaminophen toxicity occurred in nearly one-half of all cases, and this was found to be correlated with prolonged length of hospital stay. An alternative and simplified method for extemporaneous preparation may prove to be beneficial to minimize administration errors. The frequency of administration errors associated with IV N-AC can be reduced with enhanced education and improved communication between healthcare providers in the emergency department, inpatient units to which patients are admitted, toxicology consulting services, and pharmacy department.

Category: Emergency Medicine / Emergency Room

Title: Fatal pulmonary embolism in hospitalized patients: a large autopsy-based matched case-control study

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Purpose: Pulmonary embolism is an underdiagnosed major cause of death for hospitalized patients. The objective of this study was to identify the conditions associated with fatal pulmonary embolism in this population.

Methods: A total of 13,074 autopsy records were evaluated in a case-control study. Patients were matched by age, sex, and year of death, and factors potentially associated with fatal pulmonary embolism were analyzed using univariate and multivariate conditional logistic regression.

Results: Pulmonary embolism was considered fatal in 328 (2.5%) patients. In the multivariate analysis, conditions that were more common in patients who died of pulmonary embolism were atherosclerosis, congestive heart failure, and neurological surgery. Some conditions were negatively associated with fatal pulmonary embolism, including hemorrhagic stroke, aortic aneurism, cirrhosis, acquired immune deficiency syndrome, and pneumonia. In the control group, patients with hemorrhagic stroke and aortic aneurism had short hospital stays (8.5 and 8.8 days, respectively), and the hemorrhage itself was the main cause of death in most of them (90.6% and 68.4%, respectively), which may have prevented the development of pulmonary embolism. Cirrhotic patients in the control group also had short hospital stays (7 days), and 50% died from bleeding complications.

Conclusion: In this large autopsy study, atherosclerosis, congestive heart failure, and neurological surgery were diagnoses associated with fatal pulmonary embolism.

Category: Emergency Medicine / Emergency Room

Title: Securing necessary funding to provide clinical pharmacy services in the emergency department (ED) of a large community hospital: 1 year trial to permanent position

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Purpose: The American Society of Health-System Pharmacists (ASHP) has published a statement advocating for implementation of clinical pharmacy services in the emergency department. Due to the high volume, high acuity, and high stress that accompany the ED setting, the potential for medication errors and inappropriate treatment is high. However due to increasing health care costs and decreasing reimbursement, finding support of novel services can be difficult. The purpose of this project was to obtain monetary support for an ED clinical pharmacy service through a grant-funded year long trial to prove the clinical and financial impact of pharmacy services in the ED.

Methods: Implementation of the ED pharmacy service began with thorough literature searches identifying some of the key areas relating to ED clinical pharmacy practice. Major areas of research included implementation costs, strategies to gain hospital administration approval, potential monetary savings, and defining the ED pharmacist role. After compiling and prioritizing these key areas, pharmacy and hospital administrators submitted a grant proposal to the Humility of Mary Health Partners (HMHP) Development Foundation. The foundation agreed to a one year grant subject to six month preliminary documentation of clinical and economic impact. Based on previous literature, the targeted metrics to secure permanent position funding was a cost-benefit ratio of 1 to 3.43 or a return on investment (ROI) of 240%. Clinical interventions were documented on a daily basis using the Medkeeper online documentation service. The monetary value applied to different categories of interventions was derived from published literature. Surveys were conducted before and 4 months after the implementation of the ED pharmacy service. This survey identified areas of medical and nursing staff satisfaction with pharmacy services. These survey results were also presented to the foundation at the six month time period.

Results: Through the year long period, two pharmacists alternated working 10.5 hour days in the emergency room. Their roles included active participation in all cardiac resuscitations, traumas, myocardial infarctions, and strokes as well as prevention of medication errors, answering drug information questions, medication reconciliation, and ensuring proper medication selection and dosing. During the study period, a total of 7,935 interventions were documented in Medkeeper with a corresponding potential cost-savings of \$1,188,355. This corresponds to a cost-benefit

ratio of 1 to 4.4 or a ROI of 342%, exceeding the targeted figures. Additionally, a pharmacy satisfaction survey distributed to ED physicians and nurses before and after the initiation of pharmacy ED services drastically improved. The mean scores improved from a 130.2 out of possible 300 to 283 out of 300. Press-Ganey scores in the areas of adequacy of information to family/friends and information about home care improved in the initial 3 months with mean scores increasing from 63.9 to 70.0 and 70.2 to 77.8, respectively. Although this is not measuring strictly pharmacy involvement, it is likely that pharmacist interaction with patients had some impact on this improvement.

Conclusion: Through detailed documentation of interventions and cost-savings, the ED pharmacists exceeded the targeted 1 to 3.43 cost-benefit ratio and permanently secured the funding for ED clinical pharmacy services at their institution. Additionally, the service attained critical support needed from the ED physicians and nursing staff. Although accepting a pharmacist position on a limited trial basis may not be ideal, it may be an option when trying to implement new pharmacy services in an era of minimizing healthcare costs.

3-069

Category: Emergency Medicine / Emergency Room

Title: Post rapid-sequence-intubation analgesia and sedation practices in intubated emergency department patients

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Purpose: Patients undergoing endotracheal intubation in the emergency department (ED) require analgesia and sedation after rapid-sequence-intubation (RSI) to prevent adverse clinical outcomes. The purpose of this study is to describe RSI and post-RSI sedation and analgesia practices in patients undergoing endotracheal intubation in the ED.

Methods: This was a single center retrospective review of all consecutive patients intubated in an academic ED between January 2008 and April 2012. Patients were identified using hospital claims data. Patients were excluded if they were not intubated by the ED team, had an existing tracheostomy, or if records were not available. Data was analyzed using descriptive statistics, and statistical significance was assessed using two-tailed students t-test and Fishers Exact test.

Results: A total of 583 patients met the inclusion criteria. Of the 499 (85.6%) adult patients who survived the ED stay, 278 (55.7%) and 128 (25.7%) did not receive any post-RSI analgesia or sedation, respectively. Compared to patients who received succinylcholine, patients who received rocuronium were less likely to receive any analgesia (39.2% vs. 51.4%, $p=0.004$) or any sedation (71.7% vs. 84.4%, $p=0.001$). Of patients who did receive post-intubation medications, patients who received rocuronium had longer average times to analgesia (32 minutes; 95% confidence interval (CI) [26-38] vs. 47 minutes; 95% CI [37-57], $p=0.024$), and to sedation (22 minutes; 95% CI [19-25] vs. 42 minutes; 95% CI [32-52], $p=0.0002$). Further, patients receiving rocuronium were more likely to receive sedation with ED pharmacists bedside presence during intubation (81% vs. 65%, $p=0.01$). The average boarding time for patients who were intubated in the ED was 197 minutes; 95% CI [186-208].

Conclusion: An alarming rate of patients in our ED received delayed post-RSI analgesia and sedation, or none at all. ED pharmacist presence was associated with improved sedation practices for a subset of patients. A quality improvement checklist protocol for post-RSI analgesia and sedation at our institution is being developed based on these results.

3-070

Category: Emergency Medicine / Emergency Room

Title: Root cause analysis for significant outpatient adverse drug events: A qualitative analysis of patient and physician perspectives

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Purpose: Adverse drug events (ADEs) which occur when patients or caregivers administer medications are a significant cause of emergency department (ED) visits. Root cause analysis is seldom applied to understand ADEs that happen in outpatient settings. We conducted root cause analysis for outpatient adverse drug events that led to ED visits.

Methods: ED clinical pharmacists enrolled adult patients 18 years of age and older who presented to the UCSF ED with symptoms or diagnoses consistent with ADEs. We conducted semi-structured interviews of the patients and physicians and reviewed ED records. The interview questions were about patient, provider, or health system factors affecting the administration of medications all with respect to adverse drug events. Interviews were audio-taped, transcribed verbatim, and subsequently de-identified. All transcripts were coded with differences finalized via discussion.

Results: A total of 25 patients were consented and enrolled in the study. Of these, a total of 17 patients or caregivers, and 11 providers were interviewed, representing a total of 18 ED visits, 13 for chronically and 5 for acutely prescribed drugs. Our analysis identified the following themes within the injury prevention framework: agent factors including high risk drugs, with narrow therapeutic indices. Patient factors: patient capacity or understanding of how to use medications, awareness of side effects, mistrust of the medical system, and clinical acuity including patients with multiple comorbidities on multiple drugs, and difficult risk-benefit assessment. Social and physical factors: lack of social support for medication management or basic needs, and health systems issues including access to care, access to specialists, and lack of continuity.

Conclusion: Our analysis identified several common root causes of outpatient ADEs, particularly high risk drugs being used chronically in medically and socially complicated patients in health systems with limitations in continuity, access to care, and communication between providers.

Category: Emergency Medicine / Emergency Room

Title: Agitation in the elderly: evaluation of a university hospital emergency department

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Purpose: As the elderly population expands, a concern in emergency medicine is the proper treatment of agitation in those aged 65 years or older. These patients may not present with the classic symptoms of many conditions and are at an increased risk of adverse medication reactions and potentially serious conditions such as delirium. The purpose of this study was to provide data to help finalize and implement a protocol for emergency management of agitation in the elderly by summarizing the current use of benzodiazepines, antipsychotics, and opioids.

Methods: This was a retrospective, single-center, IRB approved study. Patients were identified for analysis if they were 65 years or older, treated with an opioid, antipsychotic, or a benzodiazepine in the emergency department, and had an ICD-9 code consistent with agitation. The majority of the ICD-9 codes selected are for various types of dementia. This served to target patients who may not be able to verbalize symptoms or provide a medical history; a patient population which would benefit greatly from a standardized approach. Any encounters with an obvious painful or traumatic source of agitation were excluded. A total of thirty one encounters met criteria for analysis. Information collected for each encounter included: medication administered including dose and route, the class of medication administered first, if physical restraints were used, if the patient was intubated, outcome (admitted or discharged), labs and imaging, home medications, any symptoms consistent with delirium, and if the patient had a history of dementia.

Results: The average age of the study population was 77 years old, a majority of the patients were female, and Alzheimers disease was the most commonly identified ICD-9 code. Eighteen patients were admitted to the hospital and the average length of stay was 6.3 days. For the total 31 encounters, 8 patients received an opioid, 13 an antipsychotic, and 24 a benzodiazepine. Over half received the benzodiazepine first. Twenty three (74%) of the total patients had a known history of dementia. The study population was broken down into subgroups for analysis. The first subgroup, or acute agitation group, were patients with acute symptoms possibly consistent with delirium which were not present at baseline. Nine patients were identified in this group. None of the patients received an opioid, 1 was treated with an antipsychotic, and all 9 were given a benzodiazepine to treat agitation with 7 of that 9 (78%) receiving the benzodiazepine first. The second subgroup analyzed were patients with a diagnosis of delirium made by a physician during hospitalization. While in the Emergency Department, all 4 of these patients were treated for agitation using a benzodiazepine with 3 of the 4 receiving the benzodiazepine prior to any other medications.

Conclusion: In the Department of Emergency Medicine, benzodiazepines are being used first to treat agitated elderly patients. Benzodiazepines and antipsychotics are discouraged through the

Beers list from the American Geriatrics Society. With the understanding that delirium is an under-diagnosed indicator of critical illness, and that our geriatric population is at an increased risk, evidence provided by the Society of Critical Care Medicine in the pain, agitation, and delirium guidelines for intensive care patients could be extrapolated to justify the use of analgesics first in the treatment of agitated elderly patients in the emergency room.

3-073

Category: Emergency Medicine / Emergency Room

Title: Novel program using pharmacy technicians to collect medication histories in the emergency department

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Purpose: To evaluate the percentage, frequency, and types of medication history errors made by pharmacy technicians as compared to nurses in the emergency department (ED).

Methods: Medication history errors were evaluated in a pre-post study design comparing a historical control group prior to the implementation of a pharmacy technician in the ED to a prospective cohort group (N =300). This study received approval by the Morton Plant Mease Institutional Review Board. Trained pharmacy technicians conducted medication history interviews in a systematic fashion, with outside resources being consulted as necessary. Patient allergy records and documentation of last administration times for high risk anticoagulant and antiplatelet medications were also examined. The primary outcome compared the percentage of patients with accurate medication histories in each group. Secondary outcomes included differences in total medication errors, types of errors, documentation of patient allergies and reactions, and documentation of anticoagulant/antiplatelet administration times. Anonymous surveys were distributed to ED nurses to assess their feedback.

Results: Three-hundred medication histories from the emergency department were evaluated by the PGY1 pharmacy resident. Medication histories conducted by pharmacy technicians were accurate 88% of the time as compared to 57% by nurses ($P < 0.0001$). A total of 19 errors (1.1%) were made by pharmacy technicians vs. 117 (8.3%) by nurses ([RR] 7.5; $P < 0.0001$, 95% CI of difference [-0.086, -0.055]). The most common category of error was an incorrect or missing dose (10 vs. 59, $P < 0.001$), followed by an incorrect or missing frequency (0 vs. 30, $P < 0.0001$), and a drug commission (5 vs. 23, $P = 0.004$). There were no differences between groups regarding the documentation of patient allergies. Documentation rates of high risk anticoagulant and antiplatelet administration times were greater for pharmacy technicians vs. nurses (76% vs. 13%, $P < 0.001$).

Conclusion: This study demonstrates that trained pharmacy technicians can significantly improve the accuracy of medication histories collected in the emergency department.

3-074

Category: Emergency Medicine / Emergency Room

Title: Impact of emergency department pharmacists in facilitating administration of alteplase for ischemic stroke patients

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Purpose: Intravenous administration of alteplase is the only FDA approved pharmacological therapy for treatment of patients with acute ischemic stroke. Timely administration of intravenous alteplase within 3 to 4.5 hours of symptom onset is associated with improved outcomes. The AHA/ASA Stroke Guideline recommends the door-to-needle time (time of bolus administration) should be within 60 minutes from hospital arrival. This project was designed to determine if pharmacists presence in the emergency department (ED) facilitates the preparation of alteplase, resulting in shortening alteplase administration time versus when pharmacists are not present.

Methods: This study was performed at a large academic medical center that is established as a Comprehensive Stroke Center located in New York City. Pharmacists have been assigned to staff in ED since 2008 working alongside physicians and nurses. When an ED pharmacist is notified of a stroke patient and alteplase administration is anticipated, the pharmacist reviews the patient's medication history, calculates the appropriate dose and prepares the bolus dose and drip. After the computed tomography (CT) scan result is confirmed, the bolus dose is given to the physician for administration. Alteplase administration data for acute ischemic stroke in our institution was collected from January 2012 to April 2013. The data was divided into two groups: patients treated in the ED with alteplase for ischemic stroke when pharmacists were present versus patients treated with alteplase for ischemic stroke when pharmacists were not present. The data was analyzed to determine if there was a time difference for alteplase bolus administration when a pharmacist was present to assist versus when a pharmacist was not present.

Results: Alteplase administration time ranged from 143 minutes to 21 minutes for the time period collected. The alteplase administration time was significantly better when a pharmacist was present to assist. In 2013, the average administration time when a pharmacist was present was 39 minutes, compared to 69 minutes when a pharmacist was not present.

Conclusion: Presence of pharmacists in the ED can greatly affect the care given to patients. Pharmacist services in the ED at our hospital have significantly decreased the time to administer alteplase for ischemic stroke patients. The result of the decrease in average administration time when an ED pharmacist is present complements the AHA/ASA Stroke Guideline recommendation of door-to-needle time within 60 minutes.

3-075

Category: General Clinical Practice

Title: Impact of a hospitalist pharmacist in a community hospital

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Purpose: The collaboration between a pharmacist and a hospitalist is a novel approach to optimize patient care. Pharmacists have already proven to be invaluable in settings such as critical care, emergency medicine and oncology. Our purpose was to evaluate the effectiveness of a pharmacist-hospitalist team approach to patient care in a non-teaching community hospital.

Methods: A collaborative team was formed, consisting of a physician, 2 physician assistants and a pharmacist. The team rounded on internal medicine patients for 23 days. Interventions were documented, categorized and compared to hospital wide interventions (HWI). Workflow in central pharmacy was also analyzed.

Results: During the study period a total of 1845 interventions were documented, of which 621 were completed by the hospitalist pharmacist (33% of HWI) with an acceptance rate of 99%. There were 459 drug regimen modifications (43% of HWI), 78 antibiotic interventions (18% of HWI), 54 IV-to-PO conversions (21% of HWI), 27 renal dose adjustments (20% of HWI), and 3 lab tests avoided (100% of HWI). Average number of interventions was 27 per day with an estimated cost savings between \$28,935 and \$47,718. Number of outgoing pharmacy calls dropped from 12 to 2 calls per day. The pharmacist also prevented 61 adverse drug events for a savings potential of over \$285,000. The hospitalist pharmacist provided additional benefit in core measure compliance, medication counseling, providing less expensive therapeutic alternatives and streamlining of admission and discharge medication reconciliation process.

Conclusion: Collaboration between hospitalists and pharmacists improved patient care. The addition of a hospitalist pharmacist has shown to streamline the medication process, prevent delays of therapy and improve hospital work flow.

3-076

Category: General Clinical Practice

Title: Clinical pharmacists collaboration with physicians to improve medication safety during inpatient stay in an internal medicine unit

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Purpose: Cost containment and improving patient outcome is an essential component of all acute care hospitals. Adverse drug events (ADEs) in hospitalized patients result in prolongation of hospital stay, increased economic burden and increased mortality. Accurate and effective medication reconciliation on admission and discharge, along with medication counseling, is vital for patient safety. The purpose of the study was to determine if a pharmacist can improve medication safety by collaborating with medicine team physicians, resolving medication discrepancies during inpatient stay, preventing potential adverse events, and calculate potential cost avoidance associated with the pharmacists interventions.

Methods: The prospective study, approved by the Institutional Review Board, was conducted on medicine floors for 3 months from August 2012 to October 2012. The study group included one of the six medicine teams in the internal medicine unit at the Veterans Affairs (VA) Medical Center. Initial data collection consisted of printed computerized outpatient medication list on admission. The list assisted in identifying medication discrepancies at admission by capturing all medication information including inpatient, outpatient, and non-VA obtained medications. The pharmacist reviewed all admissions in the medicine team, interviewed the patients on admission to obtain medication history, and participated in rounds on most days, including weekends and holidays as needed. The pharmacist documented all interventions in the patients chart. At the end of the study, pharmacists interventions related to medication management were reviewed by a panel consisting of two hospitalists and one clinical pharmacist to determine the type of prescribing errors. The severity was categorized using the National Coordinating Council for Medication Error Reporting and Prevention (NCC-MERP) Index, which includes nine categories based on severity and patient outcomes. The panel reviewed patients chart to decide if an actual or potential ADE would have occurred in the absence of pharmacists intervention, and potential cost avoidance of the interventions. Cost savings resulting from pharmacists interventions were also calculated.

Results: There were 160 admissions and 179 pharmacists interventions during the study period in the intervention team. Acceptance rate of the interventions by the medical team was 162 (90.5%). Numbers of medication errors categorized were 156. There were 116 (74.3%) interventions in the no harm (A-D) MERP category, 39 (25%) in the harm category (E-F) and 1

(0.64%) in the harm category resulting in death (I). The most frequent type of error was drug omission followed by wrong dose. Pharmacist identified 14 patients admitted for medication-related preventable ADEs. These patients were discharged home after the ADEs were resolved. Pharmacist identified drug omission and overdose accounting for excess length of stay and/or additional monitoring in 7 other patients. Cost avoidance resulting from the 21 interventions alone during the 3 months study period was \$211,154.00 which extrapolated to a year would have been \$894,488.00 for one medicine team. Direct cost savings related to pharmacists interventions extrapolated to a year was only \$110,440.00 due to the lower medication acquisition cost for VA, which would have been \$110,440.00 if the interventions were done in a private setting. In addition, pharmacist prevented medications worth \$3,225.50 from leaving the pharmacy for nursing home-discharged patients during the 3 months study period since they receive medications from their nursing homes. The expense of the pharmacist providing clinical services was not included in the cost analysis.

Conclusion: Direct participation of the pharmacist on the medicine team and review of all medication orders intercepted medication errors that possibly would have remained undetected. Identification of medication-related preventable ADEs by pharmacist decreased patients length of stay in hospital, improved patient outcome and was associated with great cost avoidance.

3-077

Category: General Clinical Practice

Title: Adherence of surgeons to antimicrobial prophylaxis guidelines in a tertiary general hospital in a rapidly developing country

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Purpose: To assess the standard practice of care of surgeons regarding surgical antibiotic prophylaxis and to identify gaps and suggest recommendations that may improve the current practice.

Methods: Retrospective analysis of data obtained from different surgical units of Hamad General Hospital in Qatar, was performed during three months period. All adult patients who underwent surgery and followed regimes for surgical prophylaxis as per hospital guidelines were included in the study. Data included type of surgery, antibiotic type, dose, route of administration, and duration of use.

Results: A total of 101 patients were included in the study. The majority of patients were males (80%) with mean age of 39.917 years. Overall use of antibiotics was 89%, and the most commonly used antibiotics were Cefazolin (44.6%), Cefuroxime (17.8%) and Ceftriaxone (16.8%). Whereas, Co-amoxiclav (Amoxicillin+clavulinic acid) (5.9%), Metronidazole (2%), Vancomycin (1%) and ciprofloxacin (1%) were used less frequently. The practice did not match recommended hospital protocols in 53.5% of cases. Prolonged duration of antibiotics (59.3%) was the most common reason for non-adherence followed by the use of an alternative antibiotic to that recommended in the protocol (31.5%) and no prophylaxis was used in 9.2% of cases. Rate of compliance was significantly higher among clean surgery than clean contaminated group (66% vs. 34%; $p=0.03$). Moreover, 43.6% of clean and 65.2% of the clean-contaminated procedures was non-compliant with recommended surgical antimicrobial prophylaxis guidelines of the hospitals. Surgeon adherence to antibiotic prophylaxis guidelines showed non-statistical difference between different surgical specialties ($P=0.23$).

Conclusion: Our finding confirms that lack of adherence to hospital protocols is not uncommon. This remains a challenge and there is a need to encourage all clinicians to follow hospital guidelines appropriately and consistently when using surgical antibiotic prophylaxis. There is a

potential opportunity for a clinical pharmacist to facilitate this process across all surgical disciplines.

Category: General Clinical Practice

Title: Impact of helicobacter pylori treatment on nonsteroidal anti-inflammatory drugs (NSAIDs)-induced ulcer formation in adult patients: a meta-analysis

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Purpose: Interaction between *Helicobacter pylori* (*H. pylori*) infection and NSAIDs in the pathogenesis of peptic ulcer disease (PUD) is one of the most controversial issues in gastroenterology. Research on this topic reveals conflicting data; some suggest that *H. pylori* eradication increases ulcer risk, while others show a decrease or no effect at all. *H. pylori* and NSAIDs account for the majority of PUD, therefore, defining the precise relationship between *H. pylori* and NSAIDs would provide crucial evidence for proper patient management. This meta-analysis is sought to investigate whether treatment of *H. pylori* in patients on NSAIDs therapy prevents ulcer development.

Methods: A systematic search was conducted using MEDLINE, CINAHL, Academic Search, PubMed, Embase, and the Cochrane Central Register of Controlled Trials for articles published between January 1, 1992 and December 31, 2012. The key words used were anti-inflammatory agents OR NSAIDs OR NSAID OR aspirin OR cyclooxygenase inhibitors AND *Helicobacter* infections OR *Helicobacter pylori* OR *pylori* AND eradication OR treatment. Limits entered before starting the search were humans and randomized controlled trial. Of the 1,158 citations identified, seven studies met the inclusion criteria. The primary outcome evaluated was the appearance of an endoscopically diagnosed peptic ulcer at the end of follow-up period. Subanalyses were performed to evaluate the effect of treatment in nave NSAIDs versus chronic NSAIDs users and the protective effect of *H. pylori* treatment versus proton pump inhibitor (PPI) maintenance for ulcers development. Prior to the meta-analysis, the heterogeneity of results were assessed by means of Q-test, degrees of freedom, and I². Random effects model was utilized with standard approaches to quality assessment, subanalyses, and an exploration of heterogeneity and publication bias. A cut-off p-value of 0.05 was established as a threshold for statistical significance. All results were obtained using the MedCalc software; a meta-analysis software for Microsoft Excel.

Results: Seven studies and a total of 1,491 patients were included in the analysis; 52 of 692 (7.5%) patients developed peptic ulcer in the treatment group versus 59 of 721 (8.1%) in the non-treatment group. Significant heterogeneity was found and a random effects model was performed (OR=0.94; 95% CI: 0.42-2.13, P=0.64). Two studies were included in subanalyses among NSAIDs nave patients with a total of 432 patients. In the treatment group, 7 of 212 (3.3%) patients developed peptic ulcer versus 25 of 220 (11.3%) patients developed peptic ulcer in the non-treatment group [OR=0.23; 95% CI: 0.09-0.56, P=0.003]. Meanwhile, the five remaining

studies included patients who were already taking NSAIDs on H. pylori presentation representing a total of 981 patients. In the treatment group, 45 of 480 (9.3%) developed peptic ulcer versus 34 of 501 (6.7%) patients developed peptic ulcer in the non-treatment group (OR=1.56; 95% CI: 0.79-3.06, P=0.13). Five studies with a total of 941 patients compared H. pylori treatment to PPI maintenance showed a non-statistically significant reduction for preventing non-steroidal anti-inflammatory drug-associated ulcers (9.7% versus 8.9%; OR=1.28; 95% CI: 0.46-3.55, P=0.67).

Conclusion: The meta-analysis found that eradicating H. pylori did not reduce the development of peptic ulcer in the overall population receiving NSAIDs treatment. However, evidence shows that H. pylori treatment significantly reduces the risk of peptic ulcer in NSAIDs nave patients. This means that risk reduction is more marked in patients starting NSAIDs than in patients who tolerate and were already receiving NSAIDs therapy. Furthermore, PPI therapy may offer a modest, but non-significant clinical benefit over H. pylori treatment in preventing ulcers.

3-079

Category: General Clinical Practice

Title: Enhancing the medication reconciliation process during transitions of care utilizing student pharmacists

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Purpose: Medication reconciliation is an important process during transitions of care to ensure patients have a current and accurate medication list. Our Transitions of Care Team identified an opportunity for Student Pharmacists to enhance the medication reconciliation process for patients admitted to our Home Care service. The goal was to provide support and education to improve the Home Care staff's ability and comfort level when conducting medication reconciliation, while allowing Student Pharmacists a novel opportunity to participate in an interdisciplinary setting. This venture was an initial step in implementing a pharmacy practice model initiative (PPMI).

Methods: Student Pharmacists completing their Institutional Advanced Pharmacy Practice Experience (APPE) spent three out of five weekdays conducting patient home visits with the Home Care staff. The Student Pharmacists' primary focus was medication reconciliation. They also assisted in medication teaching and offered clinical support for Home Care staff and patient inquiries. Student Pharmacists discussed interventions with the Pharmacist preceptor and documented them in a standardized format. Student Pharmacists lectured and created educational handouts on a variety of medication-related topics (e.g., insulin preparations, heart failure treatment) for the Home Care staff to reinforce knowledge. A survey was completed by the Home Care staff about their experience with the Student Pharmacists.

Results: Six Student Pharmacists completed the Institutional APPE rotation. The majority of their interventions involved resolving medication discrepancies and reducing polypharmacy issues. Twenty-one surveys were received by members of the Home Care staff. Home Care staff is comprised of 52% Registered Nurses and 48% ancillary staff, including Physical Therapists, Occupational Therapists, and Speech-Language Pathologists. After their collaboration with the Student Pharmacists, Home Care staff had an improvement in comfort level when conducting medication reconciliation and medication teaching by 61% and 70%, respectively. Ancillary staff showed the most improvement in comfort level and ability.

Conclusion: Pharmacists are an integral part of the medication reconciliation process. Student Pharmacists were successful in enhancing interdisciplinary patient care using a novel pharmacy practice model. The new practice model was extremely well received by staff and Student Pharmacists. After receiving statewide recognition from the state's Medicare Quality

Improvement Organization (QIO), several other hospitals have expressed interest in implementing a similar program.

Category: General Clinical Practice

Title: Incidence of trimethoprim induced hyperkalemia in hospitalized patients treated with sulfamethoxazole and trimethoprim

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Purpose: The antibiotic combination of sulfamethoxazole and trimethoprim is frequently prescribed to treat common bacterial infections of the urinary tract and skin. Trimethoprim is known to inhibit sodium channels in the distal nephron in a similar manner as amiloride causing a potassium sparing diuretic effect. In May of 2012, an eighty-eight year old female was admitted to our hospital for symptomatic bradycardia with a serum potassium level of 7.2 mmol/liter during outpatient treatment with sulfamethoxazole and trimethoprim. The purpose of this medication review was to determine the inpatient incidence of hyperkalemia associated with the use of sulfamethoxazole and trimethoprim and the impact of concomitant medications such as angiotensin-converting-enzyme inhibitors (ACEI), angiotensin receptor blockers (ARB), aldosterone antagonists and potassium-sparing diuretics.

Methods: A retrospective review of all patients receiving sulfamethoxazole and trimethoprim from July 1, 2012 through December 31, 2012 was conducted in January 2013. Patients were identified by a usage report query that was performed from the pharmacy information system database. A data collection form was developed to gather information on patients pertaining to gender, age, length of therapy, concomitant medications that could elevate serum potassium, renal function, administered dose, and serum potassium tracking. Outcome criteria were divided into four categories: 1, no hyperkalemia or trending of increase potassium; 2, trend of increasing serum potassium; 3, patients with hyperkalemia defined as serum potassium greater than 5.1 mmol/liter; and 4, no follow-up serum potassium was available. Results were evaluated with descriptive statistics.

Results: A total of 53 patients were identified as having therapy with sulfamethoxazole and trimethoprim during the study period with a mean of 4.5 +/- 2.3 days of therapy. Mean age of the study population was 67 +/- 17.9 years. Outcome criteria showed no hyperkalemia or trend of increased serum potassium in 36% of patients (n=19), a trend of increasing serum potassium in 34% of patients (n=18), hyperkalemia in 13% of patients (n=7) and no follow-up serum potassium available in 17% of patients (n=9). Mean serum potassium for patients who had either an increasing trend or documented hyperkalemia at baseline (n=25) was 4.02 +/- 0.84 mmol/liter with a mean days of treatment of 5.08 +/- 2.0 days. The mean age of this subgroup was 70.2 +/- 16 years. Mean change in potassium for the groups with either an increasing trend or documented hyperkalemia was 0.82 +/- 0.56 mmol/liter (n=25). Mean change in serum potassium at baseline for the group with no hyperkalemia but an increasing trend was 0.72 +/-

0.29 mmol/liter (n=18) and the group with the documented hyperkalemia showed a 1.05 +/- 0.96 mmol/liter change from baseline. Review of the subgroups of patients with an increasing trend or documented hyperkalemia showed 48% (12/25) had no additional medications that could cause the hyperkalemia with 36% (9/25) having concomitant ACEI therapy. One patient had concomitant ARB therapy and one patient had concomitant potassium sparing diuretic therapy. Two patients were on an outpatient Monday, Wednesday, Friday regimen of sulfamethoxazole and trimethoprim in addition to potassium supplementation that was continued during admission; both showed an increase trend in serum potassium for their admission.

Conclusion: Use of sulfamethoxazole and trimethoprim was associated with an increase in serum potassium during treatment. Trends or occurrence of hyperkalemia has the potential to occur in patients with or without concomitant medications. Monitoring for this potential action of trimethoprim is necessary as clinically significant rises in serum potassium are possible if not watched.

3-081

Category: General Clinical Practice

Title: The Role of the Clinical Pharmacist to Improve Postoperative Glycemic Control in Cardiovascular Surgery (CVS) to Meet the Surgical Care Improvement Process (SCIP) Four Ranking

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Purpose: The purpose of this study was to determine if real time review and glargine dose recommendations by the clinical pharmacist during transition from a continuous insulin infusion (CII) to subcutaneous insulin (SCI) would improve the SCIP-4 criteria (6 am glucose < 200 mg/dl on post-operative days #1 and # 2) .

Methods: All CVS patients at SMH who require a continuous insulin infusion in the immediate post-operative period were included in the study. To determine the most effective transition from CII to SCI, the clinical pharmacist reviewed pre-op BMI, HbA1c, previous history of diabetes, and patients home medications and post-operative CII rate. These factors were then incorporated into a recommendation for a glargine transition dose to SCI. Prior and during the implementation of this process, cases were reviewed with the Diabetes Medical Director to insure appropriate recommendations. Study time periods were as follows Baseline Time period FY 2Q 2012 to 3Q 2012 Study Time Period FY 4Q 2012 to 1Q 2013 The clinical pharmacist began rounding daily on CVS patients for during the baseline period and conducted interventions during the study period. Data was compiled and reported as a percentage achievement of SCIP-4 compliance pre and post implementation of the clinical pharmacy intervention. Statistical analysis was done using the Fishers exact test.

Results: Prior to implementation of the clinical pharmacist service, 98 of 103 patients met SCIP-4 criteria (95.1%). After implementation of the clinical pharmacist service, 119 of 120 meet SCIP-4 criteria (99.2%) The intervention did show an improvement, although not statistically significant ($p = 0.098$). (Odds ratio: 0.166; Confidence Interval: 0.0035 to 1.52). The lack of statistical significance is no surprising due to the high rate in the baseline period and the low power of the study. Post-intervention, the SMH score did exceed the achievement threshold of 94.3% and approached the national benchmark of 99.6%

Conclusion: Real time clinical pharmacy review, transition dose guidance, and staff education is feasible and effective. With this process we are reaching complete SCIP-4 compliance.

3-082

Category: General Clinical Practice

Title: Evaluation of medication reconciliation discrepancies at hospital admission

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Purpose: The purpose of this evaluation was to determine the incidence of medication reconciliation discrepancies as identified by a clinical pharmacist upon admission to a medical unit at a community hospital.

Methods: A prospective evaluation was completed over a 3 month period where thorough medication reconciliation was performed by a clinical pharmacist within 24 hours of patient admission to the medical floor. Medication reconciliation data was simultaneously collected which included home medication lists as recorded by the ED, admitting prescriber and nurse admitting the patient to the unit as well as the final verified list as obtained by the clinical pharmacist. Patient age, number of home medications, medications ordered on admission, pharmacist interventions, and whether the patient was admitted from home or a facility were also recorded. Exclusion criteria included patients admitted to hospice or comfort care and any patient in whom an accurate medication history was unable to be obtained and verified. IRB approval was not required for this quality analysis.

Results: A total of 105 patients were included in the evaluation. The average patient age was 77 years, with an average number of 10 medications per patient. Of note, 53% of patients reviewed were admitted from a facility (and thus their medical record contained a pre-printed medication list from the facility). Of the 105 patients, 63.8% of patients had medication reconciliation discrepancies, with an average number of 1.5 discrepancies per patient. For all patients reviewed, 68% of home medication lists recorded on EDs Medication Reconciliation Form were inaccurate or incomplete. This did not necessarily lead to medication reconciliation discrepancies if the prescriber or nurse on the medical floor performed thorough medication reconciliation. In a sub-analysis looking at patients sent from a facility with a printed medication list (n=57), 66.7% of home medication lists recorded on EDs Medication Reconciliation form contained errors with an average number of 1.4 discrepancies per patient. Identification of discrepancies by the clinical pharmacist resulted in a total of 104 interventions.

Conclusion: The majority of patients admitted to the medical unit experienced medication reconciliation discrepancies. Reliance on the ED recorded home medication list as the source of truth by prescribers and nurses place patients at high risk for experiencing medication reconciliation discrepancies which are often perpetuated throughout transitions of care. Medication reconciliation by a pharmacist upon admission to the floor resulted in identification of unintended discrepancies and interventions to clarify discrepancies, helping create a safer environment for the patients.

Category: General Clinical Practice

Title: Implementation of new key roles for clinical pharmacists to improve diabetes care in a community hospital, during hospitalization, upon discharge and in ambulatory care setting

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Purpose: Optimal diabetes care requires coordination between many health groups and providers. Sustained continuity of care has benefits for patients with chronic disease states such as diabetes. A good number of patients with diabetes are first diagnosed in hospitals. Early identification is key to prevent future complications. Clinical pharmacists should be key players within the interdisciplinary team to advance diabetes care at every level: during hospitalization, upon transition and after discharge in the ambulatory care setting. This project was designed to identify new key responsibilities and increase clinical pharmacists role in managing patients with diabetes across the continuum of care.

Methods: An inpatient clinical pharmacist with certification in diabetes education and management and a board certified pharmacist in ambulatory care setting worked with a multidisciplinary diabetes team to identify newly diagnosed patients with diabetes. Upon admission, a hemoglobin A1c (HbA1c) was ordered for any inpatient with blood glucose higher than 180 mg/dL. High risk for diabetes patients were referred to a prevention class following discharge. Patients with HbA1c of 9 percent or higher received diabetes education consult while in the hospital ordered by the clinical pharmacists. Based on the new protocol, clinical pharmacists ordered a diabetes education consult and facilitated a hospitalist consult for all newly diagnosed patients. Furthermore, clinical pharmacists intervened on any blood glucose below 100 mg/dL or greater than 180 mg/dL. Interventions included adding basal insulin to sliding scales, holding sulfonylureas for patients at risk of hypoglycemia and several others. A diabetes discharge form was also designed to ensure care after discharge. Follow up care was arranged with the ambulatory care clinical pharmacist and primary care provider for patients with HbA1c greater than 8 percent and newly diagnosed patients. A collaborative plan of care was developed by the ambulatory clinical pharmacist for follow-up care and management.

Results: Data following the implementation of the new guidelines reflected that inpatient clinical pharmacists ordered HbA1c tests on 84 percent of patients who fit the criteria. Twenty eight percent of these patients fit the diagnosis of having diabetes according to the American Diabetes Association standards. Of these patients, 10 percent were newly diagnosed. In high risk patients, such as patients admitted with strokes, 75 percent of patients were identified as having diabetes (HbA1c 6.5 percent or greater) or high risk for diabetes (HbA1c 5.7 percent-6.4 percent). All identified patients received appropriate interventions according to the new diabetes guidelines. Data from May 2012 to May 2013 reflected that inpatient clinical pharmacists had over 2400

glycemic control interventions second only to anticoagulation interventions. Rates of hypoglycemia were maintained at a rate of less than 1 percent and the average blood glucose was less than 150 mg/dL. Through inpatient clinical pharmacist interventions for six months, eighty-six patients identified as having an HbA1c greater than 8 percent were referred to the ambulatory care clinic where the ambulatory care pharmacist was involved in collaborative care planning with these patients. Ambulatory care pharmacist interventions in these clinics have resulted in HbA1c lowering of 2.84 percent from baseline.

Conclusion: Inpatient clinical pharmacists interventions in diabetes care were vital in identifying newly diagnosed patients with diabetes and patients at high risk for developing diabetes. Additionally, clinical pharmacists interventions helped in meeting diabetes education needs during hospital stay and ensuring diabetes continuity of care upon discharge and transition of care. Glycemic control was also maintained in a safe and appropriate range. Furthermore, ambulatory care pharmacists interventions can result in a superior glycemic control following discharge which may prevent complications and hospital readmissions.

Category: General Clinical Practice

Title: Implementation and Assessment of Pharmacist Interventions during Discharge Medication Reconciliation

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Purpose: The National Patient Safety Goal 03.06.01, established by The Joint Commission, is to accurately and completely reconcile medication across the continuum of care. Studies have shown that many medications errors escape the providers notice in the discharge medication reconciliation (DMR) process. There is evidence to suggest that pharmacists can play an important role in improving patient adherence to the appropriate medications at discharge, preventing adverse drug events, and decreasing readmission rates. The purpose of this study is to evaluate the impact of pharmacist involvement during the discharge medication reconciliation process in decreasing medication errors and 30-day readmission rates.

Methods: This study was conducted in a 400-bed private, non-profit, acute tertiary medical center and included patients over the age of 18 with the diagnosis of heart failure (HF) or chronic obstructive pulmonary disease (COPD). In addition, patients had to meet at least one criteria within each of the following three categories: 1) eight or greater scheduled medications at admit OR at least one high-risk medication (i.e. anticoagulants, diabetic medications, or antibiotic), 2) hospitalization within 12 months of study enrollment OR new diagnosis of HF or COPD, and 3) length of stay greater than or equal to two days. Exclusion criteria included transfer to another acute care hospital or transition to comfort care. On day of discharge, a pharmacist reviewed the discharge medication orders and contacted the prescriber as appropriate for discrepancies and interventions to optimize therapy. Patients were provided with a customized discharge medication chart with instructions on why and how to take their medications. Primary endpoints included the total number of pharmacist interventions on discrepancies associated with the discharge medication list and 30-day readmission rates. Secondary endpoints included time for pharmacist to complete discharge review and interventions, rate of intervention acceptance, and estimated cost avoidance associated with the interventions.

Results: A total of 93 patients were included in the study, 40 in the control group and 53 in the study group. Discharge medication review, interventions, and counseling were only provided to the study group. A total of 40 discrepancies were discovered on 27 of the 53 patients in the study group. Thirty of the 40 interventions were accepted by the prescribers. Most of the interventions were dosage or frequency adjustments, with omissions being the second most common type of interventions made. The control group was found have a 30-day readmission rate of 47.5%, while the study group had 34%, resulting in a difference of 13.5% ($p=0.206$). The average amount of time the pharmacist spent per patient for DMR was 15.8 minutes (range 10-45 minutes). A total estimated potential cost avoidance of \$132,006 was calculated based on the drug-related adverse events cost avoidance, readmission cost avoidance, and pharmacist labor cost derived from the study data.

Conclusion: Pharmacists should play an active role in DMR, especially for high risk HF and COPD patients. This study showed that more than half of patients were discharged with discrepancies on their medication lists, and 75% of the interventions resulted in changes in the discharge medication orders. Due to the small sample size, the 13.5% reduction in 30-day readmission rate did not reach statistical significance. Nonetheless, this study has shown that not only can pharmacists have tremendous positive impact on patient safety by being involved in the DMR process, pharmacists interventions can result in significant health care savings as well.

3-085

Category: General Clinical Practice

Title: Retrospective analysis of the causes, treatments and outcomes of hyponatremia in hospitalized patients

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Purpose: Hyponatremia is the most common electrolyte abnormality in hospitalized patients and can result in significant morbidity if treated inappropriately. The purpose of this study was to evaluate the causes, treatments and outcomes associated with significant hyponatremia in hospitalized patients.

Methods: The institutional review board approved this retrospective chart review of patients who were admitted with a serum sodium level of 125 mEq/L or less. Patients were excluded if the hyponatremia was chronic in nature or was due to hyperglycemia. Data was collected on age, sex, baseline sodium level stratified by severity (mild = 121 to 125 mEq/L, moderate = 116 to 120 mEq/L and severe = 115 mEq/L or less) and any related symptoms, causes stratified by volume status, treatment regimens, sodium rates of correction and outcomes.

Results: A total of 100 patients were included in the analysis. The average age was 71.4 years. Fifty-eight percent of patients were female. The majority of patients were classified as mild hyponatremia (75 percent) followed by moderate (14 percent) and severe (11 percent). The majority of patients were hypovolemic (59 percent). Symptoms were highly correlated with severity of hyponatremia as well as hypovolemic and euvolemic volume states. Treatment options reflected the underlying volume state for hypovolemic and hypervolemic patients; hypovolemic patients were given normal saline 90 percent of the time and hypervolemic patients were given a loop diuretic and/or fluid restricted 77 percent of the time. Euvolemic patients received variable treatments, likely reflective of the sometimes difficult assessment of volume status on admission. Ninety percent of patients had resolution of hyponatremia and/or symptoms within 3 days. Three patients received 3 percent saline for severe, symptomatic hyponatremia. All of these patients exceeded the recommended initial rate of infusion and one of these patients exceeded the recommended rate of sodium correction; however, there were no adverse outcomes. In fact, there were no adverse outcomes among any of the patients evaluated in the study.

Conclusion: Hyponatremia is the most common electrolyte abnormality in hospitalized patients. This study revealed that significant hyponatremia is appropriately treated when volume status is clear upon admission. All patients had resolution of hyponatremia and/or symptoms over the recommended period of time. Further study is needed regarding the utilization of hypertonic saline to evaluate safe and effective use.

Category: General Clinical Practice

Title: Retrospective analysis of falls at a large, community teaching hospital

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Purpose: The National Patient Safety Foundation estimates that more than 500,000 falls resulting in 150,000 injuries occur each year in the inpatient care setting. In addition to patient-specific factors (age, cognitive status, acute illness, comorbidities, etc.) and facility-specific factors (staffing, patient location, etc.), many medications are known to increase the risk of falling. The purpose of this study was to identify the most common risk factors associated with falls to better identify these patients upon admission and help guide pharmacist interventions.

Methods: The institutional review board approved this retrospective chart review of patients that were hospitalized for 24 hours or more and had at least one fall between 7/7/11 and 2/13/12. Data was collected on age, sex, comorbidities and admission diagnosis. Vital signs, blood glucose and the medication administration record were reviewed at the time of and the 24 hours preceding the fall. Medication incidence rates were calculated by determining number of doses associated with a fall over total number of doses of specified medication administered during the study period. Fall-specific data collected included time and location of fall as well as injury/outcome.

Results: A total of 125 patients were included in the analysis. The average age was 62.8 years and 52 percent of patients were male. The most common comorbidities in patients who had experienced a fall were congestive heart failure, dementia and a history of stroke. These comorbidities were found in almost half of patients who fell. Almost 80 percent of patients with falls were admitted directly for an acute mental status change or a condition that could precipitate such a change. Immediately preceding a fall, almost 17 percent of patients were hypotensive and 3 percent were hypoglycemic, respectively. Medications were evaluated individually and as a class, with the five most common incidence rates listed as follows: fluphenazine (7.7 percent), carbamazepine (2.2 percent), duloxetine (1.8 percent), divalproex (1.2 percent) and amitriptyline (1.2 percent). Not surprisingly, the most common classes of medications associated with falls were antipsychotics, antidepressants, anticonvulsants and benzodiazepines. Most of the falls occurred on the behavioral health (17 percent) and rehabilitation units (12 percent), during the first shift (66 percent) and without injury (64 percent) or minor injury (34 percent).

Conclusion: Falls remain the single largest self-reported incident in acute care facilities, despite well known risk factors and interventions in place to reduce the risk. This study further defines and reaffirms the fall risk population: comorbidities that contribute to gait instability or

impulsivity, admission for acute conditions that cloud sensorium and propensity for hypotension. Regarding medications, the most commonly used medications to treat cognitive behavioral disorders are precisely the ones associated with increasing fall risk. Pharmacists, through roles on interdisciplinary teams, play an important role in identifying high risk patients and utilizing skills to minimize the use of high risk medications.

3-087

Category: General Clinical Practice

Title: Gastrointestinal bleeding associated with Sorafenib in hepatocellular carcinoma treatment: a case report.

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Purpose:

Methods:

Results:

Conclusion:

3-088

Category: General Clinical Practice

Title: Pharmacy student involvement in improving inpatient immunization core measures

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Purpose: More than 50,000 adults in the US die annually due to vaccine-preventable diseases and their associated complications. To address this concern, the Center for Medicare and Medicaid Services established inpatient adult immunizations (IMM) as core measure. An interdisciplinary team was assembled to participate in the ASHP Mentored Adult Immunization Impact Program. The teams project aims were to improve documentation of vaccine administration in Meditech of all acute care, womens health, and behavioral medicine units by 20%; vaccination rates in the above stated units by 25% and attain 100% compliance in documentation of Vaccine Information Statement distribution.

Methods: The study was comprised of three phases. Pre-intervention: where baseline data from a random sampling period of approximately 7-10 days was assessed via retrospective record review of electronic data from the patients electronic chart. An intervention phase: where project objectives were devised and specific tactics were implemented via rapid cycle Plan-Do-Study-Act (PDSAs) in order to improve pre-intervention results. Lastly, during post-intervention one year later, data was recollected utilizing the same random sample method from the pre-intervention phase to evaluate improvement from baseline. All data was collected and analyzed in Microsoft Excel. An innovative intervention was the incorporation of pharmacy students in the development of an IMM service. Students assigned to a medical-surgical unit were involved in the process of screening and educating individuals on the importance of immunizations, and the administration of vaccines to accepting patients. Data was collected from the medical-surgical nursing unit, and compared to the data from the telemetry, a nursing unit that had received all other interventions; expect involvement of the pharmacy students. The four Immunization core measure rates abstracted by Quantros abstracting software were also tracked over the year period.

Results: We evaluated the percentage of omitted doses as a component of our vaccine administration documentation measures. Omitted Doses were decreased in both the Acute Care (5%) and Mother-Baby nursing units (73%). The Behavioral Medicine nursing unit had a 7% increase in omitted doses from the pre-intervention phase. For VIS distribution documentation there were improvements for all three areas: Acute care improved by 93%; Behavioral Medicine 97% and we attained our goal of 100% for MotherBaby. There were mixed results for vaccination rates; in the acute care areas there was a decrease in influenza vaccination by 17% and pneumococcal by 2%. The Behavioral Medicine and MotherBaby both had minimal increases for both pneumococcal and influenza vaccination rates. The PDSA cycle that evaluated

the student run service 10 day pilot; resulted in a 12% increase in completed documentation and decreased missed opportunities to administer vaccine prior to discharge by 25%. For the two CMS IMM core measures, there was an average increase in core measure compliance rate of 24% when comparing the first quarter results of 2012 to the first quarter results of 2013.

Conclusion: A combination of strategies including the student-run service has demonstrated overall improvement inpatient immunization compliance. All students were required to undergo the American Pharmacist Associations Pharmacy-based Immunization Delivery Training Program. The service pilot was very successful; results were reported to the nursing leadership and well received. Students had the time to dedicate to screening, education and administration of vaccines. Advantages of the service include increased interprofessional interaction between the nursing staff and the pharmacy department, and most importantly, the attainment of this essential core measure.

Category: General Clinical Practice

Title: QT on patient satisfaction: quality, quantity, tools, and teamwork

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Purpose: The Center for Medicaid and Medicare Services established Hospital Value-Based Purchasing which links reimbursement to quality measures. A portion of reimbursement is derived from patient satisfaction. The Hospital Consumer Assessment of Health Providers and Systems Survey (HCAHPS) measures patients perspectives of healthcare including medication communication. Research suggests that pharmacists can effectively improve patient outcomes as measured by higher HCAHPS satisfaction scores. The description below describes the process improvement of patient counseling and the effect on patient satisfaction.

Methods: Improvements in four processes that involve patient counseling on medication understanding were undertaken that include improving the quality of counseling sessions, increasing the quantity of patients counseled, providing counseling tools, and boosting teamwork with nursing were initiated in September 2012. Quality measures included incorporating a fundamental service model called AIDET (Acknowledge, Introduce, Duration, Explain, and Thank) which pharmacists were trained, shadowed, and coached to ensure best practices. Quantity of counseling sessions was improved through continued implementation of the Pharmacy Practice Model Initiative. The number of unit-based pharmacists increased from four (4) to five (5) pharmacists daily which improved the access to meet with patients. Providing tools for education to patients is essential for retention of information. Pharmacists provide patients with their current medication list and also offer their contact information in case the patient has questions at a later time. Finally, teamwork among other disciplines ensures a consistent message and reinforces medication teaching to the patient. Pharmacists educated nurses on valuable components of medication teaching and updated medication reference sheets available at the bedside. A private consultant firm survey was used to evaluate patient satisfaction with communication on medication side effects and indication for more timely results.

Results: The number of counseling sessions increased from a weekly average of 49 to 122 from second quarter 2012 to first quarter 2013, respectively, a 149% increase. The goal was to counsel multiple patients rather than fewer patients multiple times. An increase in medication communication scores of five percent or greater between second quarter 2012 and first quarter 2013 was considered significant. Six of ten units had a significant increase in satisfaction scores for medication indication and side effects. Of the units with a significant increase, the range was from 5.4 percent to 135.3 percent increase.

Conclusion: Patient satisfaction improved significantly on six of ten nursing units through initiation of pharmacist-driven patient counseling. Methods employed included enhancing quality of counseling, increasing quantity of patients reached, providing tools to patients, and improving teamwork with other disciplines. Additional research should be performed to

determine if more frequent interaction with the same patient is needed to further improve patient satisfaction across all nursing units.

3-090

Category: Geriatrics

Title: Prevalence and predictors of potentially inappropriate medications (PIM) in older adults receiving home health care services in Qatar

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Purpose: Home health care residents are known to be vulnerable to potentially inappropriate medications because of coexistent multiple medical conditions, increased number of medications and variable prescribers. Data on appropriateness of prescribing among these patients is limited. Home health care service (HHCS) in Qatar is an organization that provides services to all home care patients, with geriatrics being a majority. The aim of this study is to investigate the prevalence, patterns and determinants of potentially inappropriate medications (PIM) among elderly patients receiving home health care services in Qatar.

Methods: A cross-sectional study, conducted over a 3 months period, between January 2013 and April 2013. Patients 65 years and older, taking at least one medication and receiving home health care services were included. Two pharmacists conducted charts review of medical notes and prescribed medications and recorded relevant data, including patients' demographics & reported comorbidities. Potentially inappropriate medications (PIM) were identified and classified into three categories based on the American Geriatrics Society 2012 Beers Criteria-as follows: 1) Medications to avoid in older adults regardless of medical conditions, 2) Medications considered potentially inappropriate when used in older adults with certain diseases or syndromes, and 3) Medications that should be used with caution, a group that was recently added to the criteria. The primary outcome variable was estimated and tested using appropriate Z test. Quantitative variable means between users and non users of PIM was analyzed using unpaired 't' test, and chi-square test was used to assess the association between two or more categorical variables. A two-sided P value <0.05 was considered to be statistically significant. All Statistical analyses were done using statistical packages SPSS 19.0.

Results: Five hundred and one patients were included in the study, of whom the majority were females (n=336, 67.1%). Patients had a mean age (+/-SD) of 78.88 years (+/- 8.04), a mean length of stay under the care of HHCS of 3 years (+/- 2.55) and received a mean number of 10 prescribed medications (+/- 4.94). A total of 191 patients (38.2%) had at least one PIM. As per Beers criteria, 35% of medications were classified as medications to be avoided in older adults regardless of conditions and 9% as PIM when used with certain diseases or syndromes. The

majority of PIM (56%) were classified as medications to be used with caution. The two leading classes of PIM were antipsychotics (27.4%) and selective serotonin reuptake inhibitors (16%). Hypertension, depression, dementia, history of fall and number of prescribed medications were significantly associated with PIM. Odds of hypertension was 1.6 times higher [adjusted OR= 1.7; 95%CI (1.0, 2.8)], odds of dementia was 2.0 times higher [adjusted OR= 2.0; 95%CI (1.2, 3.1)], and odds of taking more than 10 prescribed medications was 1.9 times higher [adjusted OR= 1.9; 95%CI (1.3, 2.8)] in the PIM group than no PIM group adjusting to other potential covariates.

Conclusion: Prescribing potentially inappropriate medications is common among older adults receiving home health care services in Qatar, a finding that warrants further attention. Polypharmacy, Hypertension, depression, dementia and history of fall were significantly associated with prescribing PIM. Clinical pharmacists can play a proactive role in optimizing drug therapy for older adults as part of a multidisciplinary team caring for HHCS patients. Active strategies like prospective audits with one-to-one intervention and feedback could be effective in minimizing PIM prescribing. Future studies are warranted to investigate the prevalence of PIM among other facilities caring for older adults and prevent them.

3-091

Category: Geriatrics

Title: Development and Implementation of a Delirium Tool for Prevention and Early Recognition of Delirium in Geriatric Patients

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Purpose: Delirium is associated with prolonged hospital stay, higher health care expenditures, and decreased prognosis as well as increased morbidity and mortality. It is believed that 6%-56% of hospitalized patients develop delirium leading to an estimated inpatient mortality rate of 22%-76%. While prevention is key, early recognition and appropriate treatment of delirium can improve prognosis. Unfortunately the delirium diagnosis is often missed which can decrease prognosis impacting both immediate and future healthcare costs. The purpose of this project is to develop and implement a delirium flow sheet with the goal of initiating prevention strategies and improving recognition and diagnosis of delirium.

Methods: A multi-disciplinary team reviewed literature and various hospital protocols pertaining to prevention and treatment of delirium in the elderly. A nursing flow sheet was created to assess and monitor cognitive function, mobility, and sleep in efforts to prevent or identify and treat delirium. A retrospective chart review was conducted to evaluate patients on a general medical unit with encephalopathy or delirium as a secondary diagnosis followed by a prospective delirium risk assessment protocol pilot on the same unit. Exclusion criteria included patients <60yo, palliative care patients, or an admission diagnosis of altered mental status, encephalopathy, delirium, or worsening of dementia. The incidence of delirium was compared before and after the delirium risk assessment protocol pilot implementation. Also, acceptance and impact of delirium prevention interventions along with duration of daily assessments was evaluated within the post-implementation group.

Results: Delirium was identified in more patients post-implementation (6.38% vs 3.22%). Also, multiple interventions were successfully implemented and improvement in delirium assessments was observed in four patients. Finally, the delirium tool was proven to be quick and easy to use (78% of initial assessments <10 minutes; 68% of subsequent assessments <5 minutes).

Conclusion: The delirium flow sheet increases recognition and decreases incidence or severity of delirium and is also user-friendly. It is therefore feasible to implement a larger pilot including a delirium order set and involving physicians, physical therapy, and nurses.

3-092

Category: Geriatrics

Title: The importance of pharmaceutical care in treatment of depression in elderly

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Purpose: Depression is a disease that affects approximately 350 million people worldwide according to data from the World Health Organization and its incidence in the elderly has increased in recent years which, allied to chronic diseases characteristics of this age group may decrease the quality individual's life. This project was designed to demonstrate the importance of pharmaceutical care in the treatment of depression in the elderly by providing information about the disease and treatment guidance.

Methods: This is a longitudinal cohort study for which were selected 30 elderly patients (over 60 years), from quaternary level care hospital of the Sao Paulo city, previously diagnosed with depression. The project was approved by the ethics committee of the Mackenzie University. Pharmaceutical interviews were conducted with an interval of three months, to evaluate the intensity of depression with the application of Hamilton scale. The patient's knowledge about the disease was measured with a questionnaire involving the symptoms that a depressed person can present, the factors that can cause depression, the drugs indicated and what would be your conduct with a family member or friend who present with depression. The therapy adherence was measured with Morisky test before and after pharmaceutical orientation. At the first appointment, the patient received information regarding the depression, the drugs prescribed, the pathophysiological perspective (relating neurotransmitters and hormones), action mechanisms of the drugs, the duration of treatment and the adverse effects that may occur with the use of antidepressants. In addition to opening for solution of any questions of the patient and your companion to stimulate and sensitize to assist in adherence treatment. The results were statistically analyzed by t-Student test.

Results: The pharmaceutical care influenced positively on the disease knowledge, with significant increase ($p < 0,05$). In the second interview, the majority of patients were able to relate and report symptoms of depression during the survey of knowledge of the disease. Among the cited symptoms, the most common were: sadness, discouragement to perform activities and nocturnal insomnia or hypersomnia during the day. A significant decrease ($p < 0.05$) occurred between the Hamilton scale scores of the first and second interview. The treatment adherence, measured by the Morisky test, was maintained in 64% of patients and improvement was noted in 32%.

Conclusion: Pharmaceutical care has positive and effective influence as coadjuvant in the treatment of depression in the elderly, because due professional guidance, technical and humanistic, showing the elderly that someone cares about your situation, there will certainly be increased of his knowledge about the disease, reducing their anxiety not to understand what is happening, and from there influence on acceptance and improvement of depressive condition, which will support the maintenance and even in increasing adherence to treatment as confirmed in the work.

Category: Geriatrics

Title: Concordance between three GFR estimating equations and drug dosing recommendations: a simulation study in the elderly.

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Purpose: A number of equations have been suggested in the literature to estimate glomerular filtration rate. Any fluctuation in this clearance can affect medication dosing. The objective of this study is to compare kidney function categories and hypothetical drug dosage recommendations for a number of medications based on the Cockcroft-Gault (CG) equation, Modification of Diet in Renal Disease 4 (MDRD4) study equation, and the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) study in elderly hospitalized patients.

Methods: Data was pooled through a retrospective chart review of patients aged 65 and older admitted to a non critical care unit. Patients were excluded if they had acute renal failure defined as an elevation in SCr of more than 0.5 mg/dL from baseline, or end stage renal disease on dialysis. Estimated glomerular filtration rate (GFR) was calculated using the three different equations: CG, MDRD4 study equation and CKD-EPI. Concordance of the above GFR equations was calculated for the kidney function categories assigned by the FDA Guidance for Industry for pharmacokinetic studies. Dosing recommendations based on the package insert for 24 renally cleared medications were simulated using the three equations. Forty dosing recommendations were assessed due to a number of medications with multiple indications. In addition, concordance for the renally cleared dosing simulation was calculated.

Results: A total of 270 patients with an average age of 79 ± 8.9 years and mean weight of 70 ± 19.3 kg were included. Mean GFR based on the three methods was as follows: CG = 55 ± 35.83 mL/min, MDRD4 = 75.53 ± 48.4 mL/min and CKD-EPI = 66.9 ± 30.93 mL/min. Concordance of GFR estimates using MDRD4 and NKD-EPI compared to CG was 47% and 53%, respectively. Concordance between MDRD4 and NKD-EPI was 90%. Concordance of simulated drug dosing using NKD-EPI and MDRD4 compared to CG was 81% and 82%, respectively. Concordance of drug dosing simulation between MDRD4 and NKD-EPI was 98%.

Conclusion: In this patient population we found low concordance of GFR based on FDA assigned kidney function categories between CG, MDRD4 and NKD-EPI equations. However, this did not translate into the same degree of discordance with respect to dosing recommendations.

3-094

Category: Geriatrics

Title: Use of transdermal patch as biotechnological approach in the treatment of Alzheimer's disease

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Purpose: Confirm the action of biological and neurocognitive administration of Rivastigmine Tartrate in transdermal form, in patients with dementia of the Alzheimer's type, for the rational use of this medicine.

Methods: We evaluated 40 patients, volunteers, of both sexes, diagnosed with alzheimer's disease. They We evaluated 40 patients, volunteers, of both sexes, diagnosed with alzheimer's disease. They were divided into two groups, oral group (OG) and patch group (GP), and then subjected to analysis of cognition and laboratory analyzes. The assessments of cognition used the MMSE and neuropsychiatric inventory. The biological material collection occurred at baseline (day 0) and after 90 and 180 days. All samples were collected by the researcher with the assistance of a qualified nurse, and with the consent of the individuals or their guardians through subscription term.

Results: Through the analysis of graphs and tables generated, we can conclude that statistically, the Rivastigmine tartrate presents during the experiment any difference between the MMSE score and the INP. Shows a slight improvement in neurocognition of group patch, even with the decline in MMSE, which is evident in the case of dementia of the Alzheimer's type.

Conclusion: Both the oral form so as transdermal drug Rivastigmine tartrate were similar statistically with respect cognition patients after 180 days of treatment. With these results we can assume that these values remain unaffected by the application of transdermally (patch), which may be clinically interesting in the future to follow up the dosage administered.

3-095

Category: Geriatrics

Title: Evaluation of potentially inappropriate medications among hospitalized critically ill elderly patients

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Purpose: Potentially inappropriate medications (PIMs) is defined as medications which carry more risk than benefits, medications with clinically significant drug-drug or drug-disease interactions and the possible omission of potentially useful medications. PIMs can lead to the occurrence of adverse drug reactions and consequently hospitalization among elderly. The purpose of this study was to evaluate the appropriateness of prescribing medicines in hospitalized critically ill elderly patients using Beers criteria, the most consulted source of information about the safety of prescribing medications for older adults.

Methods: The institutional review board approved this prospective observational study. We reviewed the medical charts of all elderly patients admitted to the coronary care unit (CCU) and intensive care unit (ICU) in a tertiary care center in Beirut, Lebanon, over a 2 months period, between April 2013 and May 2013. All patients aged more or equal to 65 years were included in the study. Data collected included demographic data, medical histories, current diagnosis and labs, home medications, and medications initiated in the hospital. Beers criteria were used to identify the PIMs prescribed during hospitalization.

Results: Seventy four patients were included in the study (30 females and 44 males) with a mean age of 75.5 7.7 years and a mean consumption of 15.0 7.0 medications. When evaluating appropriateness of prescribed medications, 53 patients (71.6%) received at least one inappropriate medication (1.32 1.22 PIMs/patient). The most frequently used PIMs include insulin sliding scale (36%), digoxin >0.125 mg/day (22%), meperidine (8%), bromazepam (7%), and ipratropium (4%).

Conclusion: PIMs are highly prevalent among elderly admitted to CCU and ICU. There is a role for clinical pharmacists to conduct medication review and interventions among older people in Lebanon. Further research is warranted to study the impact of PIMs towards health related outcomes in these elderly.

3-096

Category: Geriatrics

Title: Evaluation of the appropriateness of prescribing in hospitalized geriatric patients using Beers criteria

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Purpose: Studies indicate that high prevalence of inappropriate prescribing in geriatric patients is associated with increased morbidity and mortality, increased cost of treatment, and decreased quality of life. Inappropriate prescribing has therefore become a significant public health issue worldwide. Recently, the American Geriatric Society has updated the Beers criteria, a compilation of medications deemed potentially inappropriate for elderly, widely used as a prescribing quality indicator. The purpose of this study was to evaluate the appropriateness of prescribing medicines in hospitalized geriatric patients using the 2012 updated Beers criteria.

Methods: The institutional review board approved this prospective observational study. We reviewed the medical charts of all geriatric patients admitted to the internal medicine floor in a tertiary care center in Beirut, Lebanon, over a 2 months period, between April 2013 and May 2013. All patients aged more or equal to 65 years were included in the study. Data collected included demographic data, medical histories, current diagnosis and labs, home medications, and medications initiated in the hospital. Beers criteria were used to identify the potentially inappropriate medications among the study participants.

Results: Seventy three patients were included in the study (41 females and 32 males) with a mean age of 74.9 7.3 years and a mean consumption of 14.24 6.80 medications. When evaluating appropriateness of prescribed medications, 59 patients (80.8%) received at least one inappropriate medication (1.96 1.58 potentially inappropriate medications /patient). The most frequently used potentially inappropriate medications include insulin sliding scale (23.8%), meperidine (15.4%), benzodiazepines (14.7%), metoclopramide (9%), and anticholinergics/antispasmodics (7.7%).

Conclusion: Potentially inappropriate medications continue to be prescribed and used in hospitalized geriatric population, despite evidence of poor outcomes. There is a very important role for clinical pharmacists to conduct medication review and interventions among older people in Lebanon.

3-097

Category: Herbals / Alternative Medicines

Title: Susceptive allergic skin reaction caused by XingSu San, a concentrated Chinese herbal medicine, in a patient with allergic rhinitis - A case report

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Purpose:

Methods:

Results:

Conclusion:

3-098

Category: Herbals / Alternative Medicines

Title: Drug-induced rhabdomyolysis in a patient not taking any medications

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Purpose:

Methods:

Results:

Conclusion:

3-099

Category: Home Care

Title: Impact of staff education program on patient quality of life and therapy satisfaction

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Purpose: Quality of life for a patient with a longterm disease process can be extremely important. For patients that must self-administer an intravenous infusion daily or even multiple times a day, the comfort and tolerability of the infusion is very important. The confidence and trust that is developed between the patient and their home infusion team (pharmacy, nursing and reimbursement) can have a significant impact on the compliance, satisfaction and quality of life of the patient as well as overall success of the therapy. In addition, these parameters are required to be monitored by accreditors in the home infusion arena.

Methods: A two phase educational program was created which contained basic and advanced disease state training of all employees of a national home infusion company in conjunction with the redesign of a patient focused assessment questionnaire. The program was designed by an experienced senior clinician to address both basic clinical, customer service and operational principles. Assessments were created to guide the clinician through a focused review of the patients needs based on the specific disease processes. The premise was that by increasing staff knowledge of the disease state; patient care, quality of life and patient satisfaction would be increased. Baseline data was obtained through telephonic assessments designed to determine a self-reported quality of life and patient satisfaction score. Based on the information gained from the initial data collected on the assessments, the assessment form was retooled to better evaluate patient satisfaction and quality of life. The information from the newer assessments evaluated the same parameters; therefore, we could effectively compare responses. Both tools evaluated quality of life and overall therapy satisfaction on a 1-5 scale with 5 representing highly satisfied. Data was collected prior to and after implementation of the education program and the new assessments.

Results: All clinical and non-clinical staff nationwide completed the basic training for each targeted disease state. Advanced training was required and completed by all clinical staff. Redesigned assessments were implemented at all sites. Patient quality of life was evaluated 6 months prior to and 6 months after the program implementation to avoid seasonal variances. At the 6 month prior mark, patients reporting quality of life as satisfactory or highly satisfactory was 75% and 6 months after implementation, this had increased to 84%. Similarly, overall therapy satisfaction was 88% highly satisfied prior to implementation of this staff education program and was 92% after implementation. Patient reported compliance with therapy went from 90% to 95%.

Conclusion: Understanding the disease state, patient needs and proper ways to care for patients not only impacts the clinician being trained but the patients that they manage. Focused staff education can lead to an increased overall quality of life and overall satisfaction for patients. A corresponding increase in compliance was seen in our patient population. Further evaluation will be needed to determine the clinical impact of the increased satisfaction with quality of life and overall therapy. This impact was not able to be assessed in this review due to changes in data points collected when the assessments were redesigned.

Category: Home Care

Title: Optimizing the Use of Intravenous Immunoglobulin in Chronic Inflammatory Demyelinating Polyneuropathy

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Purpose: Chronic inflammatory demyelinating polyneuropathy (CIDP) is an autoimmune disorder affecting the peripheral nerves with progressive weakness of upper and lower extremities. Intravenous immunoglobulin (IVIG) has been shown to improve neuromuscular impairment and reduce relapse in CIDP. Initial information suggests that many patients with CIDP are not being prescribed optimal dosing. A therapy management program was developed to guide the assessment of patients with CIDP and selection of an appropriate IVIG dosing regimen. The aim of this report is to evaluate the impact of the CIDP Optimal Regimen Evaluation (CORE) therapy management program on prescriber dosing and patient disease score.

Methods: The CIDP program is an evidence-based, five-step algorithmic loop: dose assessment, patient initial assessment, physician engagement, patient reassessment, and physician re-engagement. A retrospective review of CORE program records for patients receiving at least one dose of IVIG for CIDP between 1/1/2010- 2/25/2013 was performed. Patients were risk-ranked by dosing regimen per CORE rationale. Pharmacist-physician engagements followed CORE protocol: patients ranked as potential medium or high risk and an INCAT disease score greater than or equal to four generated a recommendation to increase dose/shorten interval; patients ranked as potential low risk with a disease score of less than four over two consecutive reassessment periods generated a recommendation to decrease dose/lengthen interval. Follow-up disease scores were performed at a minimum of every 24 weeks and compared against previous assessment.

Results: The study sample included 772 patients with CIDP under the CORE protocol. A total of 349 (45.2%) patients reported initial INCAT disease score of greater than or equal to 4, with 33 (9.5%) of those patients requiring physician engagement to recommend an IVIG regimen increase and 2 (0.6%) patients requiring physician engagement recommending regimen reduction. Of the 35 total physician engagements to adjust the dosing regimen, 19 (54.3%) regimen recommendations were accepted and 16 (45.7%) were declined. Of the 19 patients whose physician accepted the dose change recommendation, 12 (63.2%) had an improved disease score of 1 or more over baseline, while only 4 (25.0%) out of the 16 patients in the group

where regimen changes were rejected by the physician had similar improvement in disease scores at follow-up.

Conclusion: .The CORE program effectively evaluates IVIG therapy in patients with CIDP and supports physician prescribing for optimal dosing regimens. Results demonstrated a tendency toward under-prescribing of IVIG dose or duration for CIDP. When specifically reviewed by a pharmacist, in concert with INCAT disease score, approximately half of the recommended dose changes were accepted. Patient outcomes showed a trend towards improvement among patients where the recommendations were accepted, compared to patients where the recommendations were declined.

Category: I.V. Therapy / Infusion Devices

Title: Implementation of smart pumps in a mother-child hospital: a pre-post study

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Purpose: Smart pumps are expected to prevent and reduce medication errors. The implementation of smart pumps requires a significant effort and collaboration of physicians, nurses, pharmacists and other stakeholders. A total of 1045 smart pumps (62 percent for syringes, 38 percent for bags) were implemented in a mother-child Canadian hospital. The main objective was to compare the number of incidents/accidents related to parental drug administration before and after the implementation of smart pumps.

Methods: Descriptive and retrospective pre-post study. The study was conducted in a 500-bed teaching mother-child hospital. The 12-month pre-phase was from October 10th, 2010 until November 5th, 2011. The 12-month post-phase was from Nov. 10th, 2011 until November 5th, 2012. Each incident/accident reported by healthcare staff is entered in a local registry. Each incident/accident related to drug was considered. Were included all parenteral drug incident/accident that were re-coded by the research team according to the source of event (e.g. equipment, supplies or drugs) and the drug therapeutic class. For both phases, we compared the number of incidents/accidents, the number of these incidents/accidents related to drug use and to parenteral drug use, the types, the sources and the therapeutic classes associated. Incidents are defined as categories A, and B whereas accidents are defined as categories C to I according National Coordinating Council for Medication Error Reporting and Prevention.

Results: A total of 5350 incidents/accidents were reported in the pre-phase and 5695 in the post-phase (plus 6.4 percent). Of these, the number related to drug use was reduced from 2734 to 2143 (minus 22 percent). Of these, the number related to parenteral drug use was reduced from 1392 to 1214 (minus 13 percent). The number of incidents was reduced from 203 to 131. The number of accidents was reduced from 1189 to 1083. Category C events were the most prevalent accidents (845 to 761 events). The proportions of the type of incidents/accidents related to parenteral drug use were similar between both phases, notably omission (14 percent to 15 percent), wrong drug (13 percent to 17 percent) and wrong flow rate (12 percent to 15 percent). The proportions of the source of incidents/accidents related to parenteral drug use were different, notably drugs (81 percent to 87 percent), supplies (16 percent to 7 percent) and equipments (3

percent to 6 percent). The top-five most frequent items were similar for the therapeutic classes associated to parenteral drug use.

Conclusion: Many factors impact incidents/accidents reporting and occurrence. This study showed a reduction in incidents/accidents related to parenteral drug. The observed reduction of incidents/accidents cannot be solely associated to smart pumps. Such implementation comes with standardization and sustained support to clinical teams. Air bubbles events led to the creation of a task force instead of being reported in the registry. Other changes to the drug-use process during the post-phase such as additional cabinets and numerous audits for accreditation, could have impacted reporting and occurrence of incidents/accidents. Further studies are required to isolate the net impact of smart pumps on patient safety.

Category: I.V. Therapy / Infusion Devices

Title: Using smart pumps report data to decrease alarm fatigue

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Purpose: The importance of alarms cannot be understated in their ability to signal life-threatening situations in patient care that might otherwise go unnoticed. However, when alarms are sounding continuously and are often false or insignificant, they easily become background noise and tend to be ignored, a phenomenon called alarm fatigue. Many national organizations, such as JCAHO, ECRI and the FDA have prioritized alarm effectiveness as important patient safety concerns. The purpose of this report is to describe how utilizing smart pump reports assisted our pharmacy department to lead the way in reducing alarm fatigue.

Methods: Smart infusion pump technology generates actionable data/reports which can play a critical role in continuous quality improvement (CQI) initiatives for medication use. It is important for caregivers to be alert and aware of what is going on with their patients. With so many different tasks to perform throughout the day and with monitors alarming continuously, it is difficult for clinicians to complete any task without being interrupted or distracted. Distractions while performing critical tasks like dispensing or administering medications can potentially contribute to medication errors. When constantly interrupted by alarms, clinicians can become desensitized due to alarm fatigue. We analyzed alerts generated by the smart infusion pump technology for various drugs in the drug library. We assessed the number of alerts associated with overrides and edits with pump programming to then modify the drug library to make the alerts more clinically significant.

Results: By analyzing report data, it was clear that the majority of alerts were associated with high risk medications. Some less risky medications like IV fluids also resulted in significant alerts (11% - 11,630 alerts for March 2013). Sodium phosphate infusions had 95% of the programs resulting in an alert, IV acetaminophen 100%, fentanyl 65%, midazolam 12.3%, propofol 9.1%, insulin 6.9%, and norepinephrine 4.4% of programs resulting in an alert. Because of the potential for alert fatigue in our clinicians, we changed some of the drug library limits and pushed a new drug library with the hopes of decreasing overall alarm fatigue.

Conclusion: Alarm-related adverse incidents may result from a variety of factors including alarm fatigue. Smart pumps provide a wealth of data from which various reports can be created to garner insight into clinical practice. In our institution, we analyzed alert data which then enabled us to determine the medications associated with the most meaningful alerts and those associated with the least meaningful alerts. By revising drug library limits for specific

medications, we were able to decrease the number of less clinically meaningful alerts and thereby decrease alarm fatigue.

Category: Investigational Drugs

Title: Effect of sugammadex versus usual care on perioperative surgical timepoints and residual neuromuscular blockade in the post-anesthesia care unit

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Purpose: Neuromuscular blocking agents are a key component of general anesthesia, used to facilitate intubation and maintain optimal surgical conditions. Reducing times and variation in recovery from neuromuscular blockade (NMB) may improve operating room (OR) efficiency. The selective relaxant binding agent sugammadex has been shown to significantly reduce time and variability to NMB recovery. This study evaluated whether sugammadex reversal versus usual care can reduce time intervals related to perioperative patient management and reduce incidence of residual NMB at entry to the post-anesthesia care unit (PACU).

Methods: This randomized, assessor-blinded study (NCT01479764) was conducted at the Massachusetts General Hospital in elective abdominal surgery patients aged 18 years and over. An institutional review board approved the protocol and written, informed consent was received from all patients. Patients were randomized to receive sugammadex (2 or 4 mg/kg for moderate or deep NMB, respectively) or usual care (neostigmine/glycopyrrolate given as per standard center practice) for reversal of rocuronium-induced NMB. To assess incidence of residual NMB at PACU entry, the train-of-four T4/T1 ratio (primary efficacy variable) was determined by treatment-blinded personnel by neuromuscular monitoring using the TOF-Watch SX. Safety was also evaluated by blinded personnel. Time intervals related to perioperative patient management (secondary and exploratory variables) were assessed open-label as in a real operating room situation. The incidence of the primary endpoint of residual NMB (defined as T4/T1 ratio less than 0.9) at PACU entry was compared between sugammadex and usual care, with p-value calculated by chi-square test. Secondary/exploratory endpoints were analyzed with analysis of covariance on log-transformed time intervals (covariates: age, American Society of Anesthesiologists class, body mass index, comorbidity index, and length of surgery).

Results: In total, 74 and 77 patients received sugammadex and usual care, respectively (one usual care patient had no measurements at PACU entry). Sugammadex versus usual care resulted in small reductions in geometric mean time from study drug administration: to extubation, 11.0 versus 15.2 min (p equals 0.014); to patient being ready for OR discharge, 14.7 versus 18.6 min (p equals 0.021); and to actual OR discharge, 19.9 versus 24.1 min (p equals 0.020). Times between first skin incision or last stitch to extubation or actual OR discharge were not

significantly different between groups. Time from PACU entry to PACU discharge for sugammadex versus usual care was 209 versus 235 min (p equals 0.22). No sugammadex patients had residual NMB at PACU entry compared with 33/76 usual care patients (43 percent; p less than 0.0001). Eight usual care patients (10.5 percent) had a T4/T1 ratio less than 0.7 at PACU entry. Adverse events (AEs) were experienced by 52.7 percent sugammadex and 53.2 percent usual care patients, with 5.4 and 13.0 percent of sugammadex and usual care patients, respectively, having AEs considered to be drug related. Serious AEs occurred in 9.5 percent sugammadex and 10.4 percent usual care patients.

Conclusion: There was a small but significant decrease in time between administration of reversal agent and OR discharge with sugammadex compared with usual care (neostigmine/glycopyrrolate), which may translate as increased operational efficiency in a high throughput OR setting. On top of this small benefit, no patients receiving sugammadex reversal had residual NMB in the PACU, versus 43 percent of patients receiving usual care. Incidence of AEs was similar overall between treatment groups, although there were fewer drug-related AEs with sugammadex versus usual care.

Category: Leadership

Title: Medication transitions of care: a discharge medication process

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Purpose: Lowering hospital readmission rates and improving patient satisfaction scores is a primary target for health systems. Patients are often discharged on medications they cannot afford and readmitted due to non-compliance. Pharmacists in collaboration other members of the health care team are uniquely able to impact medication process and assist with patient adherence to a medication regimen. The objective of the discharge medication transition of care project is to reduce thirty day re-admission rates and improve patient satisfaction scores by ensuring patients have access to medication therapy prior to discharge.

Methods: A transition of care project in a community health system, lead by pharmacists and a multi-disciplinary team, begins at the point of entry into the hospital, and targets patients being discharged to home. RX Express, a discharge medication delivery service provided by the out-patient pharmacy was available but underutilized. This process improvement project was redesigned to include In-patient pharmacists working with physicians, nurses and social workers to provide cost effective discharge medications. The study evaluates improvement in patient satisfaction scores, an increase in percentage of prescriptions filled utilizing RX Express, and a reduction in thirty day readmission rates from January through April 2012 compared to January through April 2013 for two inpatient units. All data was obtained from an internal hospital database and Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores.

Results: Successful outcome measures compared January through April 2012 and 2013 and included an approximate twenty percent increase in patient satisfaction scores, a forty-five percent increase in the number of prescriptions filled by Rx Express; and a reduced thirty day re-admission rate for one of two units in the hospital. HCAHPS scores for patient satisfaction increased approximately twenty percent in two categories, including how the patient rated the hospital and if they would recommend this hospital to a family member. Average scores on rating the hospital increased from fifty-seven percent in 2012 to seventy six percent in 2013 on

one unit and from fifty-nine percent in 2012 to seventy two percent in 2013 on the second unit. Scores recommending this hospital to a family member, noted one unit observing an average score increase from sixty one percent to eighty-two percent and the other decreased from seventy three percent to sixty nine in 2012 to 2013 respectively. The mean volume of prescriptions filled utilizing RxExpress increased by forty-five percent. Thirty day readmission rates decreased on one unit from nine percent in 2012 to four percent in 2013. The other unit doubled in expansion size; and rates remained unchanged at eleven percent.

Conclusion: Although small in size, this project shows pharmacist involvement in the discharge transition of care process ensures patients have access to medications, by delivering medications to their hospital room, prior to discharge, thus helping to reduce thirty day re-admission rates due to inability to obtain prescription and improve patient satisfaction scores. A limitation of this process in utilizing HCAHPS scores, standardized survey instrument, relates to the generalization of this assessment tool.

Category: Leadership

Title: Have I got a job for you! Part II: One approach to address succession planning for pharmacy leadership positions

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Purpose: Within the federal system, it has been reported that greater than 50% of the current workforce will be eligible to retire within the next two years. Many of these expected retirements will include leadership roles resulting in a knowledge deficit. The VA Healthcare System of Ohio (VISN 10) established a pharmacy work group in 2009 to address succession planning. Due to the retirement projections, the group decided to focus on leadership positions. The clear plan of action was to identify and provide opportunities to develop and strengthen the skills of current employees to become the future pharmacy leaders.

Methods: The Pharmacy Succession Planning work group has developed a variety of programs designed to enhance leadership skills, build confidence, and provide exposure to pharmacy leadership positions to staff interested in professional development. In 2010, a one-day leadership program was provided to eighteen participants, including pharmacists, technicians, and administrative staff from four of the five VISN 10 facilities. The feedback from the 2010 program led to the development of a shadow program that allows the participant to spend dedicated time with a current pharmacy leader. A 2011 pilot shadow program with four participants was conducted. The purpose of the pilot program was to obtain comments on the experience, logistical arrangements, and overall value. This feedback was incorporated into a curriculum for the enhanced 2012 program which was expanded to nine additional participants. The enthusiastic response from the 2012 shadow program participants and comments from the Pharmacy Chiefs steered the work group to develop a one year, pharmacy-specific VISN leadership program for staff interested in learning more about the continuously changing role of the pharmacy leader.

Results: Sixteen individuals, pharmacists, pharmacy technicians, and administrative staff, completed the required application process and were invited to participate in the 2013 Pharmacy Leadership program. A robust agenda for the program has been developed that entails two shadow experiences; monthly educational sessions on various topics such as a pharmacy benefits management program overview, patient safety, and labor relations; review of a leadership book; and discussions with pharmacy leaders on the day-to-day challenges. A conference call outlining the program expectations to the participants has been conducted. Shadow leads have been selected based on the needs identified in the participants application. Each participant has

arranged the first of the two shadow experiences. Speakers with pharmacy leadership expertise have been identified and confirmed. The goal of the program is to increase the skills, qualifications, and confidence of individuals that could potentially fill vacant pharmacy leadership positions. Approximately six months following the 2012 shadow program, a survey was sent out to determine if the participants went on to serve in a leadership role. All participants applied for leadership opportunities, including committee positions. The work group anticipates that current program participants will follow the same course.

Conclusion: Since recognition in 2010 with a poster presentation at the American Society of Health-System Pharmacists (ASHP) meeting, the work group has continued to develop and enhance training modules to alleviate the projected pharmacy leadership deficit. VISN 10 continues to document significant efforts to provide succession planning and leadership development opportunities to interested pharmacy staff. The group is collaborating with the VHA Pharmacy Recruitment and Retention Committee to roll out similar initiatives to other VISNs facing the same challenge.

Category: Leadership

Title: Developing a novel process for pharmacy resident research

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Purpose: Completion of a research project is required for ASHP-accredited post-graduate pharmacy residency programs. Most residents have limited experience with the research process and significant guidance is typically warranted. The approach to managing resident projects varies with each program. The main components of resident research are identification of a project, data collection, incorporation of statistical analysis, and presenting results. The purpose of this report is to describe a novel approach to provide a support structure for pharmacy resident research. The goal is to promote clinically meaningful projects that can be accomplished in one year for all residents in our program.

Methods: A subcommittee of the residency advisory committee was formed at our institution. Representatives of the group included two clinical pharmacy specialists, one drug information pharmacist, and two pharmacy administrators. This committee is responsible for developing research guidelines that are distributed to the residents prior to the residency start date as well as delivering a formal presentation during their first week of training. The research project guidelines include instructions for institutional review board (IRB) training and deadlines for various assignments/presentations throughout the residency year. Importantly, the research committee is available to help navigate the health system for data collection and analysis and provide oversight to achieve research goals and completion by the end of the residency year.

Results: A formal process was developed with a clear goal to conceive, complete, and strongly encourage publication of one independent research project during the residency year. Residents complete IRB training by the end of their first week of residency and identify their own research question. Residents present their ideas and the research committee identifies and coordinates the necessary resources for the project. The committee also appoints two practitioners to be the research mentors. Submission to the IRB is completed by the end of August to allow for data collection earlier in the year. In three years of this research process, 10 of 11 (91%) residents successfully identified their own research question. All 10 of those residents submitted a complete research protocol to the IRB by the August deadline. The residents have many opportunities to present results throughout the year. Final manuscripts are completed prior to finishing the residency year. Feedback from outgoing residents has been positive overall and their perceptions of their research projects and the process are positive.

Conclusion: Pharmacy residents selecting their own research projects for their residency year is a feasible alternative to assigning or providing lists of research projects to select. Identifying a project in their interest area allows for ownership of the project. An advanced timeline allows for unexpected obstacles in the research process to be overcome. If unforeseen barriers for project completion are identified, an alternative strategy for project completion can be employed. As this process becomes more seasoned and the projects continue to advance, we anticipate more publication submissions to peer-reviewed journals.

Category: Leadership

Title: Medical student perceptions of pharmacy integration into a medical relief student organization

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Purpose: A pharmacy school at a nationally recognized metropolitan research institution created a sister organization to a medical relief student organization at the medical school. This provided interprofessional education (IPE) opportunities for both medical and pharmacy students. The results of a survey demonstrating medical student perceptions of pharmacy integration, specifically into medical relief trips to Haiti and Nicaragua are presented.

Methods: An anonymous and voluntary post-trip survey was designed to assess medical students' perceptions of pharmacy involvement and enable program improvements of pharmacy services. Surveys included a Likert scale (five point) and open ended questions with an emphasis on experiences with pharmacy students, satisfaction of pharmacy services, and importance of interprofessional care. All of the medical students from the Haiti team were given surveys at a mandatory post-trip debriefing, while those from the Nicaragua team received the same survey via SurveyMonkey. Data from each medical relief trip was combined and analyzed descriptively.

Results: The Haiti team consisted of two physicians, sixteen medical (fourteen M2, two M4), and five pharmacy students (four P3, one P2). The Nicaragua team consisted of two physicians, one pharmacist, seventeen medical (three M1, eleven M2, three M4) and four pharmacy students (three P2, one P1). The survey response rate was 82% with the average age being 25 years old and 56% male. Eighteen (67%) had been on a prior medical relief trip and four (15%) reported having some experience practicing with pharmacists prior to these trips. All agreed (19%) or strongly agreed (81%) that interprofessional care is needed to maximize patient care. Twenty-five agreed (37%) or strongly agreed (56%) that the trip enhanced their understanding of a pharmacist's role. Students reported satisfaction with overall pharmacy services (100%), pre-trip medication packing (78%), clinic medication organization (93%), therapeutic (85%) and dosing (85%) recommendations provided by the pharmacy team. All students agreed that the pharmacy team positively impacted overall clinic flow (100%) and that it was important to have a pharmacy team on their trip (100%) and on future trips (100%).

Conclusion: The expansion of a medical relief student organization to include pharmacy has provided multiple IPE opportunities. A survey of medical student perceptions of pharmacy integration revealed increased exposure to the practice of pharmacy, enhanced understanding of

the role of a pharmacist and an overall satisfaction with pharmacy services. The success of these experiences has ensured continued pharmacy participation as an interprofessional student organization with the medical school. The joint organization will continue to work together to plan annual interprofessional medical relief trips and to provide programmatic improvement.

Category: Leadership

Title: Development of an interprofessional clinical skills game competition

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Purpose: The promotion of interprofessionalism among health professional students is considered key for improving healthcare delivery and patient outcomes. By fostering and facilitating working relationships through game competitions, interprofessional competencies might be better developed and integrated into the field. A game competition that allows students from the different healthcare disciplines to meet and work together toward a common goal can support the importance of an efficient healthcare team and build respect among the professions. In addition, a competition that promotes interprofessional communication skills further expands this importance.

Methods: The game competition chairs extended invitations to students from the colleges of pharmacy, medicine, nursing, and public health to take part in the interprofessional competition. Those specifically invited from each college to participate were first-year doctor of pharmacy students, first-year doctor of medicine students, both bachelor and master of nursing students, and both master and doctor of public health students. One faculty member from each college was approached to help in the question development and judging of the competition. Efforts to fundraise and to find donors for the competition (prizes and refreshments) were made by all members of the sponsoring student organization (the Student Society of Health-System Pharmacists). Before the game competition, a social event was organized that allowed the contestants an opportunity to meet. The game competition included three rounds of healthcare related trivia, where the contestants were able to collaborate with their teammates to provide the correct answer. The first round was a trivia flash round followed by two rounds of Jeopardy. The competition questions were developed to include concepts representative of each college as well as general healthcare knowledge.

Results: Six teams of four were randomly formed, each containing one student from each college. The top three teams received the grand prizes and the other contestants received a consolation prize for their participation in promoting interprofessionalism. The student organization was able to procure the necessary funds through fundraising and donor support from faculty, local businesses, and other students. The social event held for the contestants proved to be beneficial for those who attended, but didn't generate as much interest as was hoped. The competition questions were effective in revealing the overlap in knowledge between the represented student professionals, as well as their areas of expertise. On the day of the competition, there was a small audience of faculty members, fellow students, and guests of contestants. Overall, the competition generated considerable interest and appreciation. The

faculty members were impressed with the competitions outcome and were supportive of future interprofessional endeavors of this type. The professional health students involved were equally impressed and enjoyed the opportunity to be a part of a healthcare team in a game environment. The event also produced networking opportunities among those who participated, which may increase the prospect of future working relationships.

Conclusion: The clinical skills game competition proved to be a success in endorsing the importance of the interprofessional healthcare team. Providing professional health students with early opportunities to be interprofessionally involved may help pave the way for more effective teamwork and respect among the professions.

Category: Leadership

Title: Exploring the Diversity of Discourse and Voices in the Pharmacy Community: Authors, Speakers, and Terms

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Purpose: The objective of this study was to characterize the authors, speakers, topics, and trends in the pharmacy community as represented through national conferences and journals.

Methods: The speakers and topics were tabulated for all continuing education (CE) presentations at the American Society of Health-System Pharmacists (ASHP) Midyear Clinical Meeting, American College of Clinical Pharmacy (ACCP) Annual Meeting, and American Pharmacists Association (APhA) Annual Meeting conferences for the years 2010-2012. All ACPE-accredited CE topics were included. Industry-sponsored CE programs were excluded. The three organizations' respective publications, American Journal of Health-System Pharmacy (AJHP), Pharmacotherapy, and the Journal of American Pharmacists Association (JAPhA) were also evaluated between the years of 2010-2012 and data was collected on the authors and terms that were published. The topics and terms were categorized and analyzed by their respective Medical Subject Heading (MeSH).

Results: There were 3,115 speakers and authors captured for the study period. The majority of pharmacists (90.6%) had one to two speaking opportunities and fewer than 1% of had seven or greater opportunities for presentation and authorship. The top ten topics comprised 64% of all MeSH terms. The top 3 MeSH terms encountered were practice management, anti-infective agents, and cardiology.

Conclusion: There appears to be a wide diversity of voices and topics in the pharmacy community. Potential applications range from contrasting professional organizations to comparing and trending the popularity of subjects between communities.

Category: Leadership

Title: Implementation of a pharmacist merit assessment tool to improve engagement and participation

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Purpose: Pharmacists have misunderstood the subjective annual evaluation process and often been overlooked for their contributions, especially those that aided another professionals career advancement. There is a need for an objective evaluation tool that provides clarity and acknowledges the contributions of the employee. This tool should provide incentive to actively participate and reward the employee.

Methods: Pharmacist Merit Assessment Tool was created to provide an objective means of recognizing pharmacists contributions and participation in department projects and extracurricular activities. The pharmacy leadership still utilizes the organizations evaluation process, but enhances this procedure with this merit tool to provide pharmacists clarity to the evaluation process. The tools first section has two parts: prerequisites and competency expectations. Here pharmacists are either compliant or not (nineteen areas), if eighteen or more is considered fully competent and able to increase their merit in section two. Anything below this mark is classified as minimally competent or needs development, which requires an action plan to re-attain fully competent. The tools second section has nine parts: performance/participation, continuing education, certifications, presentations, projects, preceptorship, team participation, membership, and specialty assignments. Each part is broken down into specific tasks or achievements, but here credits are assigned to each. Pharmacists attain these credits for their contributions. The year-end total is then scaled into three merit categories: fully competent, fully competent plus, and exceeds expectations. These three merit categories carry weighted increases for the merit raises offered by the organization.

Results: The Pharmacist Merit Assessment Tool was initially well received by the hospital pharmacists for its objectivity and clarity of leaderships evaluation process, and then it became a valued worksheet for the pharmacists to attain personal goals, be recognized for professional achievements and instill ownership in the objective part of their evaluation. Because of the tools success and acceptance, it has been offered in a different version for the retail pharmacists with the next step being expansion to evaluation of the pharmacy technicians. Disciplines outside of nursing became aware of the Pharmacist Merit Assessment Tool and adapted the tool within their department as objectives and initiatives to engage their staff and promote career development receiving wide acceptance and excellent responses.

Conclusion: As the budgets continue to get tightened, the remaining method of recognition is through the evaluation process. By providing clear objectives and ways of acknowledgement, the Pharmacist Merit Assessment Tool has provided incentive to participate and contribute to the departments goals and organizations strategic initiatives.

Category: Leadership

Title: Maximizing the skills and contributions from pharmacy specialty technicians: an innovative approach

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Purpose: Pharmacies need pharmacists to be decentralized with a greater clinical presence on the patient units. Pharmacy technicians are valuable assets that are often an untapped resource to alleviate the workload of pharmacists. By fully utilizing the well-established pharmacy technician in a greater capacity and advancing the technician role as a recognized healthcare career, the pharmacy can maximize resource allocations.

Methods: A technician specialist role description and duties model (pyramid) was created to establish the tasks so that these highly skilled individuals can work independently. Clinical specialist focuses on review of adverse drug reactions, override reports, Pyxis discrepancies, anesthesia audits, and IV to PO switches. Procurement specialist is responsible for every drug that flows into and out of the organization, such as drug recalls, drug shortages, narcotic receiving, contract adherence (340B), formulary product management, and drug budget accountability. Regulatory specialist is the organizations medication unit inspector who ensures compliance oversight of government regulations, infection control, and proper policy adherence. Lastly, the operations specialist, or lead tech, acts as the direct supervisor by overseeing all technical tasks and duties in conjunction with the assigned workflow and schedule. The operations specialist orients all new staff including pharmacists, and ensures all medications are safely and securely delivered to the patients. There are even shared duties between specialists like staff 797 compliance and annual competency along with pinch-hitting during staff shortages. All functions of the technician specialist are coordinated with the supervision of a pharmacist.

Results: Pharmacists have been effectively deployed to the emergency department and critical care areas along with active participation in specialized projects like BOOST and pain management. Medication reconciliation, anticoagulation management, pharmacokinetic dosing and discharge counseling have been incorporated into pharmacists daily routine with great success due to technician specialists assuming more responsibilities. The technician specialists found the new workload rewarding and a great method of career advancement, which they initially thought had been a stagnant job. The organization, especially nursing, has also recognized the valuable contributions by these technician specialists and further establishing the technicians role in healthcare. Outside consultants hired by the organization to evaluate the pharmacy departments productivity and alignment recognized the technician specialist role and model as a best practice. Recently hired leaders in the pharmacy department also found this to be a best practice and seek to enhance the role even more.

Conclusion: Technician specialists provide valuable contributions and are recognized as highly skilled individuals with a passion for their career choice. The relationship between these

specialists and the pharmacists has been enhanced further through full utilization of the specialists technical expertise.

Category: Leadership

Title: Student perceptions of the value and role of student organizations in professional skill development

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Purpose: Previous studies have shown that student involvement in leadership and service may help predict future commitment to the pharmacy profession. The purpose of this study was to identify factors that influence student involvement and leadership within organizations and to assess students perception of the impact of being involved in organizations on their professional skill development.

Methods: In this IRB-approved study, a survey was administered to fourth year pharmacy students at a large college of pharmacy in the Midwest (N=202). Survey questions were developed using the published literature and expert consensus. The respondents were asked to identify which factors had the largest influence on their decision to be involved in organizations and which factors had the largest influence on their decision to pursue a leadership role. They were also asked to indicate the extent to which they felt being involved influenced key professional skills. Finally, they were asked if they would continue to be involved in organizations after graduation.

Results: A total of 158 students completed the survey, for a response rate of 78%. A total of 130 respondents (82%) indicated that they were involved in at least one organization during pharmacy school and 75 of these (58%) held a leadership position at some point. The reasons that had the largest impact on involvement were desire to present a more well-rounded image to employers (n=62), ability to network with peers and mentors (n=57), and interest in the activities sponsored by the organization (n=53). The reasons that had the largest impact on pursuit of a leadership position within a student organization were interest in developing leadership skills (n=62), ability to include it as an accomplishment on a CV (n=62), and liking the feeling of giving back (n=56). Students indicated that being involved in professional organizations had the strongest impact on their assertiveness, leadership skills, teamwork, and confidence. Most respondents (83%) indicated that they would like to be involved in professional organizations after graduation.

Conclusion: The majority of students surveyed are involved in professional organizations in a leadership capacity. Presenting a well-rounded image to employers and developing leadership

skills are the top reasons why students get involved and pursue leadership roles. Being involved appears to have a positive impact on professional skill development and a large percentage of students surveyed would like to stay involved in professional organizations after graduation.

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Category: Leadership

Title: How to assess your health-system's cultural readiness for implementation of the Pharmacy Practice Model Initiative (PPMI)

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Purpose: This case describes the methods used to gain understanding of a 15-hospital health-systems organizational readiness for implementation of the PPMI as perceived by pharmacy and other healthcare disciplines.

Methods: Two surveys were used to assess opportunities, barriers, and cultural readiness for implementation of the PPMI in a 15-hospital health system. The Ministry Health Care (MHC) PPMI Consensus Survey, an internet-based survey created using the original PPMI Self-Assessment Survey, was designed to collect data from multiple healthcare disciplines. The survey utilized a Five-to-One Likert scale and was distributed to key stakeholders across the system. The PPMI Self-Assessment Survey was distributed to MHC senior pharmacy leadership. Data was collected and reported by ASHP. Results from both surveys were compared for opportunities and barriers to implementation of the PPMI to analyze for organizational readiness. Focus was placed on consensus statements and their corresponding self-assessment questions that presented either the largest opportunity or barrier.

Results: In the consensus survey, pharmacist practice statements received the highest mean score (4.23), automation and technology statements had the second highest mean score (4.16), and pharmacy technician role statements had the lowest mean score (3.27). Associated ASHP PPMI Self-Assessment questions showed opportunity for increased pharmacist presence on multi-disciplinary teams as well as use of barcode scanning. Lack of cultural readiness and understanding were identified barriers to expanding technician dispensing responsibilities.

Conclusion: Using the ASHP Self-Assessment tool along with an internal cultural assessment of key stakeholders can provide a clearer picture of where to focus practice advancement efforts. By following this approach, MHC has found opportunities and barriers to advancing pharmacy practice.

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Category: Nutrition Support

Title: Unusual cause of oral intolerance and need for parenteral nutrition

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Purpose:

Methods:

Results:

Conclusion:

Category: Nutrition Support

Title: Total nutritional pharmacy service at neonatal intensive care unit at a university hospital in Korea

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Purpose: Nutrition for sick newborn infants, both term and preterm, is very important factor for mortality and morbidity, which mainly consist with parenteral and enteral nutrient solutions. While nutritional therapy is served as a main calorie source for growth, it is associated with several metabolic complications. The aim of the study was to evaluated the impact of pharmacists invention on nutritional therapy results and outbreaking of nutritional therapy-related complications in neonatal intensive care unit(NICU) at a tertiary teaching hospital in Korea.

Methods: The approval of retrospective, observational study protocol from the hospital institutional review boards was obtained. We analyzed the medical reports of all NICU neonate and premature infants from January 2011 to October 2012, and divided study period as control period(from January 2011 to June.14. 2012) and intervention period(from June 15 2012 to September 2012) according to a pharmacist's intervention. Inclusion criterion was the neonates who were treated with parenteral nutrition (PN) at birth for 7 or more days at NICU. Exclusive criteria were the neonates who were (a) on TPN for less than 7 days, (b) transferred out of NICU while on TPN, (c) deceased to discharge, or(d) duplicated between period. Perinatal details and clinical characteristics were collected, actual parenteral and enteral intakes were daily collected to calculated as the sum of the nutrient components using unit per kilogram(amino acid, dextrose, lipid, etc). Complications were compared. In intervention period, pharmacist calculated nutrition intakes combined TPN and enteral nutrition, provided individual nutritional chart on daily basis, reviewing TPN protocols with team members. In control period, pharmacist reviewed TPN prescriptions alone. Data were analyzed using SPSS version 17, unpaired student t-test, the Mann-Whitney test, and Fisher's exact test.

Results: total 58 infants were included and compared. No significant difference in mean gestational age, birth weight, days at initiation of enteral feeding, duration of TPN, and TPN complications. On the 7th day of administration, TPN compositions and/or EN separately and together were compared with intervention and control groups. Although there were no significant differences in: TPN composition, duration of TPN administered, initiation of the enteral feeding and treatment duration on both TPN and enteral nutrition, intervention group results were preferable. The days at regaining birth weight was significantly shorter (14.5 days; 19 days, respectively, p equals 0.049) and the percentage of the days with total calories over 90 kcalories

per kg per day over the duration of TPN administration was significantly higher (40 percent; 13 percent respectively, p equals 0.008) in intervention group compared to the values in control group. In the intervention group, the total mean daily caloric intakes (84.8 Kcalories per kg per day; 74.8 Kcalories per kg per day, respectively, p equals 0.018) significantly higher than those results in control group, that was explained that adding effect of TPN and enteral feeding calories. No significant differences in mean biochemical parameters, metabolic imbalances and nutritional therapy related complications.

Conclusion: Pharmacists intervention of an individualized nutrition therapy in neonates provided a shorten time to regain birth weight, allowed a greater amount of Kcalories to be provided. Compared to the control group, the intervention group achieved better calorie intakes without significant nutrition therapy-related complications. That may suggest that the advantage of pharmacists intervention assures the best possible nutrition and biochemical control.

Category: Oncology

Title: Cost effectiveness analysis comparing enzalutamide, abiraterone and cabazitaxel for the treatment of castration resistant prostate cancer post docetaxel therapy from third party payer perspective

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Purpose: Castration recurrent prostate cancer (CRPC) is an advanced stage of prostate cancer that occurs with progression of disease and resistance to androgen deprivation therapy. Docetaxel therapy is first line in the treatment of symptomatic CRPC. Until recently, docetaxel was the only treatment option for this progressive form of prostate cancer. Recently enzalutamide, abiraterone and cabazitaxel have been approved for second line treatment after docetaxel failure. Currently, no cost effectiveness studies have been done comparing these three agents from third party payer perspective. The objective of this cost effectiveness analysis is to provide a recommendation to third party payers regarding the use of these agents from an economic and effectiveness standpoint.

Methods: A cost effectiveness analysis was done on male patients over the age of 18 with clinically diagnosed castration recurrent prostate cancer. A third party payer perspective was utilized in this analysis. A Markov model was used to compare abiraterone, enzalutamide and cabazitaxel in regards to cost effectiveness of each treatment option. Direct costs of the medications, overall treatment cost of prostate cancer, and infusion costs were all included in the model. Measurements of efficacy included time to disease progression, probability of death, and probability of progression. A 3% discount rate was applied and sensitivity analyses were conducted for drug costs, probability of progression and probability of death for each treatment arm.

Results: In the base case, abiraterone had the lowest cost of \$93,729.84, followed by enzalutamide with \$116,738.30, and cabazitaxel with \$127,095.10. Cost-effectiveness analysis showed that compared to abiraterone, enzalutamide had an incremental cost of \$23,008.46 with 1.82 life-months gain and cabazitaxel with \$10,356.83 and -1.7 life-months gain. In one-way sensitivity analyses, abiraterone was shown cost-effective due to its low base cost and its total effectiveness of 12.58 months. Enzalutamide had the highest total effectiveness of 14.4 months, but with its base cost, enzalutamide was shown less cost-effective than abiraterone. Cabazitaxel

was the least cost-effective agent based on its high base cost, probability of death, and probability of progression.

Conclusion: Based on the results of this cost effectiveness analysis, abiraterone was found to be the most cost effective option in comparison to enzalutamide and cabazitaxel in the treatment of CRPC.

Category: Oncology

Title: Identifying the rate of invasive aspergillosis in patients undergoing induction chemotherapy for acute myeloid leukemia at a university hospital

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Purpose: Invasive aspergillosis (IA) in patients undergoing induction therapy for acute myeloid leukemia can be rapidly fatal. A study comparing posaconazole to itraconazole or fluconazole for prophylaxis against IA in this patient population showed a survival benefit in the posaconazole group with a baseline rate of infection of six percent. IA can be difficult to diagnose and the baseline rate of IA at UAB Hospital is currently unknown. The objectives of this study were to identify the rate of IA in patients receiving AML induction therapy and determine whether or not prophylaxis for IA is appropriate at UAB Hospital.

Methods: Patient charts of those who received induction chemotherapy for acute myeloid leukemia (AML) from July 2010 to June 2012 were reviewed retrospectively to determine the incidence of IA. The factors used to determine possible IA were fever curve, antibiotic use, aspergillus galactomannan, culture data, radiographic findings, and biopsy results.

Results: Fifty patients admitted to receive induction chemotherapy for AML were enrolled. Of those 50 patients, 20 (40%) received an antifungal agent which provides coverage for IA, 9 (18%) had a chest computed tomography (CT) with findings suggestive of IA, and 3 patients (6%) had a positive galactomannan. Only 2 patients (4%) had both a positive chest CT and a positive galactomannan. The other positive galactomannan was likely a false positive due to concomitant use of piperacillin/tazobactam. The data for fever curve was not used due to several confounders. There was only one biopsy which may have been a cutaneous fungal infection and there were no cultures positive for IA.

Conclusion: The baseline rate of IA is at least 4% in patients undergoing AML induction therapy at UAB Hospital. This rate of IA is very close to the 6% rate where prophylaxis has shown to improve survival and these patients will likely benefit from prophylaxis for IA. The Medical Director of inpatient hematology and the Antimicrobial Stewardship Committee have agreed to start using voriconazole for prophylaxis. The guidelines for use of antifungal agents were amended to reflect the change in practice and were approved by the Pharmacy and Therapeutics committee.

Category: Oncology

Title: Impact of pharmacist intervention in the gynecology oncology infusion clinic

Primary Author: Kristina Frinzi, UAB Hospital, 1728 Jefferson Tower, 625 19th Street South, Birmingham, AL, 35249; Email: kfrinzi@gmail.com

Purpose: To determine and define the impact of pharmacist intervention in the gynecology oncology infusion clinic at UAB Hospital.

Methods: This was a single center, IRB-approved study in which data collection occurred from June 2010 to July 2012 and then again from December 2012 to February 2013. The STARS Enterprise database was utilized to collect all medication errors and adverse drug reactions during the previously defined dates. In an attempt to capture data that would not have been documented in the database, a separate data collection sheet was utilized to document clinical interventions performed by the pharmacist from December 2012 to February 2013. All medication errors, adverse drug reactions and clinical interventions were evaluated for pharmacist involvement and reclassified based on type of intervention. Statistical analysis was not performed on the data.

Results: There were a total of 11,256 medication orders processed in the gynecology oncology infusion clinic over the 27-month study period. Of these, 86% were for chemotherapy and 14% were for non-chemotherapy. The pharmacist performed a total of 314 interventions including dose adjustments (62%), therapy adjustments (25%), adverse drug reaction (ADR) management/prevention (6%), drug information consultation (4%), and supportive care management (3%). The average time to complete such interventions was 16.1 minutes with a range of 15-45 minutes.

Conclusion: Although many studies have been conducted in the inpatient setting at UAB Hospital, this is the first study documenting the impact of pharmacist intervention in the outpatient oncology setting. Despite the many limitations of this study, these results indicate that pharmacist involvement remains critical to ensuring optimal patient care. While this study did not include a cost analysis, future studies evaluating financial outcome data could serve as additional support for the incorporation of a pharmacist in the oncology infusion clinic.

Category: Oncology

Title: Economic evaluation of oncology pharmacist intervention in an ambulatory cancer center

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Purpose: Even though clinical pharmacists are actively involved in patient care, many of their efforts remain undocumented, resulting in an underestimation of the importance of their services. This study was aimed to document and evaluate the cost effectiveness of oncology pharmacist intervention in an oncology outpatients setting.

Methods: This was a retrospective descriptive analysis of clinical interventions by the clinical oncology pharmacist from October 1, 2012 to March 31, 2013 in Asan Medical Center, Seoul. All interventions were evaluated for type and frequency, probability of harm and economic consequence, including cost avoidance and cost savings.

Results: A total of 822 interventions were documented among 41,650 patient visits. Average time spent per intervention was 5.3 minutes. The most frequent types of pharmacist interventions involved chemotherapeutic agents dosing and schedule. The overall economic benefit was \$129,670. The mean total cost avoidance for all 555 interventions was \$120,000, the mean total cost savings for all 267 intervention was \$9,670.

Conclusion: Clinical outcome of pharmacist intervention may not be assessable for several reactions. Our result demonstrates that oncology pharmacist interventions are most likely to lead to favorable economical outcomes.

Category: Oncology

Title: An analysis of incidence and risk factor for peripheral neuropathy by Bortezomib in patients with multiple myeloma

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Purpose: Bortezomib has been recognized as an effective treatment in patients with multiple myeloma with no previous experiment or patients who have failed previous standard therapy. Bortezomib is used as an inhibitor of proteasome in the ubiquitin-proteasome pathway that is essential for maintenance of homeostasis. But, peripheral neuropathy (PN) is a major non hematologic side effect of bortezomib and it occurs dose dependently. PN drops the quality of life in patients and is likely to lead to dose reduction, treatment delay, and early drop out. Therefore, it is important to estimate the risk factors.

Methods: This study was performed from 1 May 2005 to 30 April 2008 and the data was obtained retrospectively from 108 patients treated with bortezomib at Seoul National University Hospital. We recorded the frequency of PN before and after administration bortezomib, risk factors, and medication records of anticancer drugs that might affect the occurrence of PN. The data were statically analyzed by SPSS 19.0

Results: As a result, gender and age had no effect on frequency and severity of PN. However, creatinine level (Scr 2 mg/dL), diabetes mellitus, and number of bortezomib cycle ($N > 3$) had significant effect on frequency and severity of PN. The odd ratio for each risk factor was 0.264, 0.324, 4.046 respectively. When we adjusted each risk factor, a higher creatinine level caused lower risk of PN occurrence. (OR=0.248) When bortezomib cycles were repeated more than 3 times, the risk of PN increased. (OR=4.235) The severity of PN was not associated with chemotherapy with other neurotoxic drugs. The incidence of PN appeared to be lower in group with previous experience of bortezomib, bortezomib+thalidomide, and bortezomib+vincristine.

Conclusion: When it comes to estimate bortezomib induced PN incidence rate, it is believed that active interventions are required for individual PN symptom. That's because risk factors such as medication history of other anti-neoplastic agent and renal function of patient profile are inadequate.

Category: Oncology

Title: Oral chemotherapeutic-specific admission medication reconciliation process in a community hospital

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Purpose: Reconciliation of oral chemotherapeutic medications upon admission was identified as a major area of concern at our institution; given our absence of a pharmacist driven medication reconciliation program and the often narrow therapeutic range of these medications. The project was designed to develop a process for an oncology-trained pharmacist to reconcile all admission orders for oral chemotherapeutic medications prior to administration.

Methods: Our computerized order entry system was modified to display a warning identifying all chemotherapeutic medications that required further review by an oncology-trained pharmacist. The oncology-trained pharmacist then assessed the order and processed as appropriate. Oral chemotherapeutic medications prescribed by an oncologist or other specialist prescribing within the scope of their specialty (example: rheumatologist prescribing methotrexate) were not subject to an oncology-trained pharmacist review. Oral chemotherapeutic medications ordered on weekends were assessed the following Monday. The oncology clinical specialist was paged if immediate assessment was needed on a weekend order. The hospital's pharmacy and therapeutics committee and medical executive committee approved the oral chemotherapeutic medication-specific reconciliation program prior to initiation. Descriptive statistics were used to assess the effectiveness of the program.

Results: From May 2012 to March of 2013, one hundred and thirty-two oral chemotherapy orders were assessed. Sixty-three percent of the orders contained at least one prescribing error; eighteen percent of the orders contained more than one error. Internal medicine physicians accounted for eighty-one percent of prescribed orders with an error rate of sixty-four percent. Wrong frequency (thirty-three percent) and contraindication (thirty percent) were the most common causes for prescribing errors. Nearly sixty percent of orders were prescribed on second shift, which is consistent with known hospital admission patterns. On average, three orders were assessed per week, with each assessment taking roughly twenty minutes.

Conclusion: An oral chemotherapeutic-specific medication reconciliation program has prevented potential adverse drug events in over half (sixty-three percent) of prescribed oral chemotherapeutic medications with minimal increase in pharmacist resources (roughly one hour per week).

Category: Oncology

Title: Cost-Effectiveness Analysis of Bortezomib Plus Dexamethasone vs. Carfilzomib in the Treatment of Relapsed and Refractory Multiple Myeloma

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Purpose: In 2012, multiple myeloma was responsible for 10,710 deaths in the United States, with current treatment options only providing a 34% survival rate at a five-year follow-up. Although many studies have been conducted on the use of bortezomib in relapsed/refractory multiple myeloma, data are limited on a newer proteasome inhibitor, carfilzomib. Carfilzomib, unlike reversible proteasome inhibitor bortezomib, is irreversible and has demonstrated efficacy in relapsed and refractory multiple myeloma. Further investigation is warranted on the efficacy and costs associated with carfilzomib in comparison to the standard-of-care bortezomib.

Methods: Using a third party payer perspective, a Markov model was implemented to examine the cost effectiveness of bortezomib versus carfilzomib in relapsed/refractory multiple myeloma patients. The median age of the patients was 63 years. The study compared the approved dosing regimen of carfilzomib, which is 20 mg/m² intravenously on days 1, 2, 8, 9, 15, and 16 of a 28-day cycle, repeated for 3 cycles, or a total of 84 days, to bortezomib 1.3 mg/m² intravenously with dexamethasone 40 mg by mouth on days 1, 4, 8 and 11 of a 21-day cycle, repeated for 4 cycles, or 84 days. Dose reductions due to adverse events were taken into account, as bortezomib has traditionally demonstrated higher rates of peripheral neuropathy. Neuropathy secondary to carfilzomib is reported in 12.4% patients, compared to bortezomib at 41%. A lifetime horizon was utilized, as multiple myeloma is not a curable disease. Each cycle through the model is 84 days long, which covers three 4-week cycles of carfilzomib treatment or four 3-week cycles of bortezomib with dexamethasone. A discount rate of 3% was used.

Results: Base case results were as follows: The cost of bortezomib/dexamethasone to complete three treatment regimens is \$86,123 extending the life expectancy an average of 25.5 months. The cost of carfilzomib to complete three treatments is \$99,196 extending life an average of 13.6 months. Bortezomib dominates carfilzomib with its lower cost and better outcomes in the model. One-way sensitivity analyses were conducted for major inputs derived from the literature. The sensitivity analyses showed that our base case results were robust when tested over a wide range of inputs.

Conclusion: After running a Markov model on comparing bortezomib/dexamethasone with carfilzomib in patients with treatment refractory multiple myeloma, bortezomib/dexamethasone was the dominant treatment option in this economic evaluation from the third party payer perspective.

Category: Oncology

Title: Retrospective review of carboplatin dosing in a community hospital

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Purpose: At present, there are no clear guidelines whether actual body weight (ABW), ideal body weight (IBW), or adjusted body weight (AdjBW) should be utilized in the Cockcroft-Gault (C-G) equation for carboplatin dose calculation in obese patients. The goal of this study is to determine optimal weight descriptor for estimating glomerular filtration rate (GFR) to be utilized in carboplatin dose calculation via Calvert formula in obese patients.

Methods: This is an IRB approved retrospective chart review conducted at Baptist Hospital of Miami. All patients greater than or equal to 18 years of age who received at least one dose of carboplatin as monotherapy or as a part of combination chemotherapy regimen for solid tumor malignancies between June 2011 and July 2012 with baseline laboratory and follow up (21 days after chemo) laboratory parameters were included in the study. Patients less than 18 years of age, patients diagnosed with leukemia, lymphoma, and myeloma, patients with missing baseline laboratory or follow up laboratory parameters were excluded. Patients with ABW greater than or equal to 20 percent of IBW were categorized as obese patient group;, remaining patients were categorized as normal weight patients (control) group. To determine number of patients with carboplatin dose difference greater than 10 percent, patients creatinine clearance (CrCl) was calculated manually by using the C-G equation using AdjBW; carboplatin doses were calculated manually based on calculated CrCl and using the Calvert formula. Calculated carboplatin doses were compared with carboplatin doses prescribed. To determine incidence of carboplatin dose limiting toxicities, pre and post treatment platelet count, electrolytes level and serum creatinine were collected and compared.

Results: A total of 177 patients received carboplatin during the study period, 99 patients were excluded and 78 patients were included. Forty-four patients were defined as normal weight, and 34 patients were defined as obese. Number of patients with difference in dose greater than 10 percent using ABW and adjBW for carboplatin dose calculation was 29 (85.3 percent) in obese patients, and no patients had a dose difference greater than 10 percent in normal group. For assessment of carboplatin dose limiting toxicities, 11 patients (6 adjBW in the C-G equation, 4 flat-fixed dosing, 1 dose difference less than 10 percent) from obese patients; 5 patients (flat-fixed dosing) from normal group were excluded. In obese patients, 12 (52.1 percent) had thrombocytopenia, 13 (56.5 percent) experienced hypokalemia, 3 (13 percent) had acute renal injury. From normal patients, 12 (30.7 percent) had thrombocytopenia, 13 (33.3 percent) had hypokalemia, and 3 (7.7 percent) patients experienced acute renal injury. Follow up magnesium

level were available for 21 patients in obese, and 20 in normal patients. Hypomagnesemia was found in 14 (66.7 percent) obese, and 12 (60 percent) in normal patients.

Conclusion: The current study showed that using ABW in the C-G equation to estimate GFR in the Calvert formula was associated with a higher incidence of carboplatin dose limiting toxicities in obese patients. Our findings are consistent with the results of previous studies despite of our study limitations. In obese patients receiving palliative chemotherapy, using adjBW should consider in carboplatin dose calculation to reduce the incidence of carboplatin dose limiting toxicities.

Category: Oncology

Title: Dedicated chemotherapy pharmacist...is there a need?

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Purpose: In January 2013, our 99 bed rural hospital dedicated one of its four staff pharmacists to the role of chemotherapy pharmacist to evaluate and ensure appropriate chemotherapy practices in our facility. The purpose of this study was to determine if this transition resulted in any significant adjustments to treatment regimens for our patients.

Methods: Data was collected for the four month period from January 2013 to April 2013. A total of 126 chemotherapy plans and 272 medications were reviewed. For the purpose of this study, dose, frequency, schedule, and medication selection were evaluated for appropriateness.

Results: Twenty seven chemotherapy regimens were questioned and seven were modified (26%) by the prescriber to address concerns presented by the chemotherapy pharmacist. Thirty one medication dosages were questioned with nine being adjusted (29%) to reflect the chemotherapy pharmacists recommendations. The seven plans adjusted were comprised of the following changes: 3 medications dosages were reduced and 2 were increased, the frequency of administration was reduced 3 times and increased once, and two regimens required the addition of an omitted medication. The most common reasons for not following the pharmacists recommendations included: extended dosing schedules due to toxicity concerns, the ability to control the disease progression with a decreased dose for decreased side effects, and following the recommendations of the patient's oncology specialist.

Conclusion: Our oncology providers accepted a significant percentage of changes recommended by the chemotherapy pharmacist. The addition of this position has increased the quality of patient care at our facility.

Category: Operating Room Pharmacy

Title: Waste anaesthetic gases in Quebec hospitals

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Purpose: In Quebec, Canada, there exists no concentration ceiling value for at least two anaesthetic gases: sevoflurane and desflurane. The National Institute for Occupational Safety and Health recommends a 2 parts-per-million (ppm) ceiling value for halogenated gases. There exists a risk of occupational exposure to waste anaesthetic gases at many steps of the drug-use process, namely at the reception, storage, administration and waste management steps. The purpose of this study was to describe the airborne concentration of two anaesthetic gases in Quebec hospitals.

Methods: Sevoflurane and desflurane air concentration were measured in three Quebec hospitals in 2011 and 2012. Sevoflurane air sampling was performed in fixed locations near the patients breathing zones in pre-operative care units, intensive-care units and post-operative care units. Sevoflurane air sampling was also performed near the workers breathing zones in pre-operative care units, operating rooms, day surgery units, intensive-care units and post-operative care units. Sevoflurane concentration was also measured directly at the exit of the ventilator for three patients in a post-operative care unit. Desflurane air sampling was performed in fixed locations near the patients breathing zones in pre-operative care units and post-operative care units. Desflurane air sampling was also performed near the workers breathing zones in pre-operative care units, operating rooms, day surgery units and post-operative care units. Air sampling duration varied between two and eight hours. The limit of detection (LOD) varied between 0.07 ppm and 0.10 ppm for sevoflurane and between 0.03 ppm and 0.04 ppm for desflurane.

Results: Mean sevoflurane concentration in fixed locations near the patients breathing zones was lower than the LOD in the pre-operative unit, and 0.48 ppm in the post-operative care unit. Mean sevoflurane concentration near the workers breathing zones was lower than the LOD in pre-operative and day surgery units. One sample of 0.08 ppm was obtained in the pre-operative unit and one sample of 0.08 ppm was obtained in the operating room. Mean concentration of 0.23 ppm in the intensive care unit and of 0.24 ppm in the post-operative units were obtained. After a 30-minute period post-operation, sevoflurane concentrations measured at the exit of the ventilator were of 440, 512 and 720 ppm. Three hours post-operation, the mean concentration was 123 ppm. Sevoflurane was still exhaled by the patients five hours post-operation. Desflurane concentration in fixed locations near the patients breathing zones was lower than the LOD in pre-operative units, and the mean concentration was of 7.79 ppm in post-operative care units. Mean

desflurane concentration near the workers breathing zones was lower than the LOD in the day surgery unit. One sample of 0.029 ppm was obtained in a pre-operative unit and the mean concentration was 0.43 ppm in the post-operative unit.

Conclusion: Few studies exist about environmental monitoring of waste anaesthetic gases in North-America. Waste anaesthetic gases concentrations were low in workers breathing zones. The post-operative care unit was the location where the highest concentrations of sevoflurane and desflurane were found. Sevoflurane was still exhaled more than five hours post-operation in the intensive care unit. This study highlights the importance of adequate ventilation throughout the anaesthetic gases use process, including storage areas and post-operative care areas. Scavenging of anaesthetic gases should also be done also in intensive-care units. Pharmacists must be involved in optimal anaesthetic gases use throughout the hospital.

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Category: Operating Room Pharmacy

Title: Possible extrapyramidal reaction with ondansetron in an obstetric patient following endometrial ablation requiring an intensive care unit admission

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Purpose:

Methods:

Results:

Conclusion:

Category: Pain Management

Title: Evaluation of Patient Outcomes, Length of Stay, and Average Hospital Costs with IV Acetaminophen: A Case-Matched Analysis of a National Inpatient Hospital Database

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Purpose: Perioperative intravenous (IV) acetaminophen has been reported to reduce post-surgical pain and opioid consumption. We hypothesize these clinical benefits of IV acetaminophen could translate into faster recovery times and lower average hospital costs in US hospitals.

Methods: Diagnosis and procedure codes were systematically used to identify inpatient total hip arthroplasty (THA) and total knee arthroplasty (TKA) admissions to hospitals participating in the national inpatient hospital database maintained by the Premier healthcare alliance, representing data collected from over 550 hospitals throughout the US. Cases (patients who were given IV acetaminophen on the day of surgery) were matched to controls (patients who were not given any IV acetaminophen during their hospital stay) with respect to hospital, type of surgery and anesthesia, marital status, 3M all patient redefined [APR] DRG severity and mortality admission scores (exact matches required), as well as gender and age via an estimated propensity score. The data, which were collected from patients admitted between January 1, 2011 and November 30, 2012, were analyzed for differences in adverse event (AE) incidence (captured through ICD-9 and DRG coding and rescue drug utilization), average hospital costs, and length of hospital stay (LOS). In addition, we explored the same endpoints when four doses of IV acetaminophen were given instead of a single dose. Cases were compared with controls using paired t-tests (for continuous outcomes) or repeated-measures logistic regression (for dichotomous outcomes).

Results: Out of 248,766 billing patient records, 7,156 THA and 16,110 TKA patients were matched. Groups were similar in age, race, insurance status and morbidity and mortality scores. THA patients: In 3,578 matched patient pairs, AEs were lower with IV acetaminophen (24.5%) than with control (27.5%, $p=0.001$). IV acetaminophen use was associated with shorter mean LOS (2.86 vs 2.96 days, 2.4 hours difference, $p<0.0001$) and lower average costs (\$16,890 vs \$17,275, \$385 difference, $p=0.02$). TKA patients: In 8,055 matched patient pairs, AEs were lower with IV acetaminophen (24.7%) than with control (26.4%, $p=0.007$). IV acetaminophen use was associated with shorter mean LOS (3.01 vs 3.10 days, 2.2 hours difference, $p<0.0001$) and lower average costs (\$16,223 vs \$16,899, \$675 difference, $p<0.0001$). THA patients (502 matched patient pairs) receiving 4 doses of IV acetaminophen vs one dose had shorter mean LOS (2.68 vs 3.03 days, 8.4 hours difference, $p<0.0001$) and lower average costs (\$15,428 vs.

\$16,296, \$868 difference, 5.3% of total inpatient costs, $p=0.02$). TKA patients (1,106 matched patient pairs) receiving 4 doses vs one dose had shorter mean LOS (2.95 vs 3.13 days, 4.3 hours difference, $p<0.0001$) and lower average costs (\$15,166 vs \$15,786, \$620 difference, 3.9% of total inpatient costs, $p=0.01$).

Conclusion: IV acetaminophen for major hip or knee arthroplasties was associated with significantly fewer adverse events, shorter mean length of stay, and lower average hospital costs compared to control. Four doses of IV acetaminophen, compared to a single dose, were associated with a shorter mean length of stay and lower average hospital costs.

Category: Pain Management

Title: Total joint center continuum of care: a transition of care process for orthopedic surgery patients

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Purpose: To provide a description of an expanded role for a pharmacist in the orthopedic joint center of a community health system from out-patient to in-patient transition of care project.

Methods: All patients admitted for a knee arthroplasty are medically evaluated preoperatively by a registered nurse and surgeon. The total knee arthroplasty pre-admission process was redesigned to include contacting the in-patient joint center pharmacist when patients with baseline drug therapy pain related medicated issues were identified through the development of a pain medication questionnaire. During the course of normal job activities, the pharmacist called the patient to discuss baseline medication use, provided an individualized post operative medication therapy plan and communicated the plan to the surgeon who initiated the orders. All patients are re-evaluated post-operatively by the pharmacist, in the joint center as a group, and individually when needed. Any remaining drug therapy issues were identified, communicated and resolved. HCAHPS (Hospital Consumer Assessment of Health Plans Survey) pain score averages were compared at baseline from January through April 2012 to January through April 2013. Intangible costs were reported.

Results: The process identified an average of 3 opiate tolerant patients weekly and proactively identified other patients at risk for post-operative nausea and vomiting and other medication related side effects. At least one medication related overdose was prevented based on false patient reporting of baseline opiate use. HCAHPS scores were evaluated, the first question was, how well was the patients pain controlled, score was sixty one percent at baseline and remained unchanged at sixty two percent in 2013. The second question asked, Did the healthcare staff do everything to control your pain, scores improved from seventy eight percent in 2012 to eighty-six percent in 2013. The average length of stay in days, for knee patients for January, February, March and April 2012 when compared to 2013 were equivalent at 2.7 to 2.7 in January, 2.9 days to 2.8 in February, 2.7 to 2.6 in March and 3.0 to 2.6 in April. The intangible cost savings which resulted due to an increase in efficiency were calculated based on eight hundred dollars per day room rate or thirty three dollars per hour for 15, 24, 26 and 34 patients per month respectively, totaling fifteen thousand dollars.

Conclusion: Pharmacists play an integral role in medication management of in-patient knee replacement patients. Identifying patients during the pre-admission screening process who are at risk for adverse related medication events post-operatively is cost effective and contributed to

improved patient pain scores relating to patient perception of doing everything to help pain. However, the HCAHPS score relating to pain well controlled was unchanged and may be the result of poor understanding of pain expected with knee arthroplasty. Future studies are recommended to examine this issue.

Category: Pain Management

Title: Impact of interdisciplinary collaboration on HCAHPS pain scores by enhancing a decentralized pharmacy model

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Purpose: To improve HCAHPS pain management composite scores through the enhancement of an established decentralized pharmacy model.

Methods: Members of the Pain Management Committee identified ways a pharmacist can work collaboratively with staff on nursing units to improve pain management. The group decided on key pharmacy activities to incorporate into the current decentralized pharmacy model that would benefit staff and patients which included pain rounds with nursing staff, pain consults (with physician recommendations when applicable, patient profile reviews, and patient education. The nursing staff was educated on the role of the decentralized pharmacists in pain management and how to use their services.

Results: In August 2011 56.5% of patients answered always to the HCAHPS question during your hospital stay how often was your pain well controlled? compared to 66.7% post implementation year to date as of June 2012. Prior to implementation, 68.5% of patients answered always to the question during your hospital stay how often did the hospital staff do everything they could to help you with your pain? while 69.1% answered always post implementation.

Conclusion: The collaborative implementation of an enhanced decentralized pharmacy model is effective in improving the HCAHPS pain management domain scores especially as it relates to pain control.

Category: Pediatrics

Title: Retrospective review of a pharmacist initiated immunization pediatric practice protocol for influenza and pneumococcal polysaccharide (PPSV23) vaccines

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Purpose: Immunization rates of influenza and pneumococcal polysaccharide (PPSV23) vaccines are one of the quality initiatives for the Centers for Medicare and Medicaid Services (CMS) for accountable healthcare organizations. To meet this quality initiative, a pharmacy collaborative practice agreement (CPA) was created to improve the vaccination rates of influenza and PPSV23 vaccines due to laws requiring a physician's order for vaccines in children. The purpose of the study is to evaluate the effectiveness of the pharmacist initiated vaccine protocol for influenza and PPSV23 vaccines in the pediatric population in comparison to the physician initiated protocol that was previously utilized.

Methods: The institutional review board approved this retrospective chart review to evaluate a standard practice, which included the screening of all patients admitted to the pediatric hospital for influenza and PPSV23 vaccination. A pediatric pharmacist screened all patients admitted to the medical and intensive care floors from October 15, 2012 to March 31, 2013 to assess current vaccination status and ascertain if the patient qualified for influenza and/or PPSV23 vaccination based on the current immunization recommendations established by the Advisory Committee on Immunization Practices (ACIP) and CMS guidelines. The pharmacist completed the documentation and ordered vaccines prior to discharge per the CPA. Patient charts were reviewed to assess accuracy and completion of correct immunization documentation and vaccines ordered and administered. Patients were excluded from analysis if they did not meet the age requirements for vaccination (influenza: less than 6 months; pneumococcal: less than 2 years) or were pediatric hematology/oncology or surgery patients, as they were exempt from the CPA. The primary outcome was achieving greater than 90 percent immunization success rate for influenza and PPSV23 vaccinations in all patients meeting the inclusion criteria. The secondary outcome was to compare the pharmacist initiated to the physician initiated protocol for influenza vaccination.

Results: Appropriate documentation for influenza and PPSV23 vaccination were achieved 96.1 percent and 91.8 percent of the time, respectively. Influenza vaccines were ordered 97.9 percent of the time; however of those ordered, only 69.7 percent were administered. PPSV23 vaccines were ordered 76.7 percent of the time with 57.1 percent being administered by discharge. Of the missed opportunities for influenza and PPSV23 vaccinations, 29.6 percent and 35.7 percent of

patients, respectively, were admitted less than 24 hours. The physician initiated data from February 2012 (number equals 100) for influenza demonstrated 45.8 percent were appropriately documented with only 29.2 percent ordered and administered.

Conclusion: Despite the inability to achieve a greater than 90 percent immunization success rate for influenza and PPSV23 vaccination, the data from the pharmacist initiated protocol proved to be more successful than the physician initiated protocol in documentation, ordering, and administration of the vaccines. The outcomes of this study provided support to continue the pharmacist initiated CPA, identify barriers to success, and add another pharmacist to the pediatric service. In addition, it demonstrated in the pediatric population that a pharmacist initiated CPA can be a successful tool in achieving the goals set forth by CMS for accountable healthcare organizations.

Category: Pediatrics

Title: Evaluating the use of erythromycin to increase tacrolimus levels in pediatric kidney transplant recipients

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Purpose: Children's Healthcare of Atlanta uses the CYP3A4 interaction between erythromycin and tacrolimus to help kidney transplant recipients reach their goal tacrolimus level. The purpose is to evaluate the effectiveness of using erythromycin to increase tacrolimus levels.

Methods: The institutional review board approved this retrospective, single center, quality improvement study. Retrospective chart reviews were conducted for patients receiving kidney transplants from January 1, 2007 to December 31, 2012. Data collected included patient demographics, primary disease state, graft rejection, tacrolimus dose/adjustments, tacrolimus levels, erythromycin use/therapy length/dose, and adverse effects from erythromycin. Secondary outcomes included adverse events, effectiveness of therapy in different race/gender groups, effective dose of erythromycin, and transplant rejection.

Results: Fifty-one of 164 patients initiated erythromycin therapy. There were statistical significant differences between prescribing patterns for race and age in the erythromycin and non erythromycin groups ($P \leq 0.01$). The erythromycin group was 55% African American. Forty three percent of patients in the erythromycin group were between the ages of 11-15. The median date of erythromycin initiation after transplant was 9 days. The median time to therapeutic tacrolimus levels after initiation was 22 days. There were 13 patients (25%) with documented adverse events from erythromycin, including six patients who required inpatient stays. Tacrolimus levels increased by an average of 6.1 ng/mL when erythromycin was added. The highest increase in levels was seen in African American patients.

Conclusion: African Americans between the ages of 11 and 15 received erythromycin more than any other patient group in the study. Erythromycin had a high rate of adverse events and took approximately a month to get tacrolimus levels therapeutic. On average erythromycin raised tacrolimus levels by 6.1 ng/ml.

Category: Pediatrics

Title: Harmful excipients in neonatal unit

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Purpose: Excipients are a minimal part of drug compounding, so classically they are classified as an inert part of the drug. However, at neonatal units, the harm that excipient can produce is a growing concern. The aim of this poster is to review commercial liquid oral forms used at neonatal unit and to look for excipients known to be harmful to neonates that are in these medicines.

Methods: We made a list of all commercial oral liquid forms used at neonatal unit during 1 year. Drug, therapeutic group, pediatric use, neonatal use and excipients were collected from label info. If label info is not available we used leaflet. Harmful excipients to neonates (methylparahydroxybenzoate, propylparahydroxybenzoate, saccharin sodium, sodium benzoate, benzyl alcohol, benzalkonium chloride, propylene glycol, polysorbate 80 and ethanol) were selected. We reviewed medicines selected in order to know if they had harmful excipients.

Results: A total of 20 drugs were selected, 11 were antimicrobials and 9 were classified in other groups (gastrointestinal drugs: 2, vitamins and minerals: 3, central nervous system drugs: 3, cardiovascular drugs: 1). Pediatric use was referred in 19 drugs. Neonatal use or information related to the possibility of neonatal use without contraindications was reported in 13 medicines. Methylparahydroxybenzoate was presented in 10 drug formulations, propylparahydroxybenzoate in 9, sodium benzoate in 5, saccharin sodium in 7, ethanol in 3, polysorbate 80 in 3 and propylene glycol in 6. Distribution of harmful excipients were: 1 harmful excipient in 5 drugs, 2 harmful excipients in 5 drugs, 3 harmful excipients in 8 drugs and 4 harmful excipients in 1 drug. Only one has not any harmful excipient.

Conclusion: There is a need for careful toxicological assessment of excipients and pharmaceutical companies should be aware of toxicity to select correct excipients if formulation is for neonatal use. Pharmacists and neonatologists should know the excipients of medicines to select the most appropriate medicines for neonates. If harmful excipient is not avoided, it is important to know what the risk is for neonates.

Category: Pediatrics

Title: Assessing copper, manganese, selenium, and iodine deficiency in pediatric patients receiving parenteral nutrition and predicting supplementation through serum and urine monitoring

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Purpose: Trace minerals are an essential part of several enzyme systems used in metabolism. Pediatric patients have a higher susceptibility to trace deficiency because of rapid physical development. The purpose of this abstract is to determine the time required for the occurrence of trace mineral deficiencies in patients who are receiving parenteral nutrition with and without trace mineral supplementation of copper, manganese, selenium, and iodine.

Methods: This is a retrospective study of pediatric patients receiving parenteral nutrition supplemented and not supplemented with trace minerals. Copper and selenium are assessed using serum levels, iodine using urine iodine measurements, and manganese using whole blood. All trace minerals are collected in trace mineral free tubes and measured by a national laboratory. The standard levels as reported: copper range 75-153 ug/dl, manganese 4.2-16.5 ug/L, selenium 23-190 ug/L, and iodine < 100mcg/L. Copper is not assessed unless the C reactive protein is less than 4mg/dl. Urine iodine levels were not assessed if patients received any iodine products. Supplemented patients received copper 20 mcg/kg/day, manganese 5mcg/kg/day, selenium 3 mcg/kg/day, and iodine 3 mcg/kg/day. Data is reported as supplemented and non-supplemented identifying the number of levels assessed, average level, and number of days before levels was drawn. The number and percentage of patients showing low, normal, and high levels. Mann-Whitney is used to determine if there is a difference between the supplemented and non-supplemented levels .

Results: Supplemented copper patients had 751 levels drawn with an average draw time at 20 days and average serum level of 80mcg/dl. Of these 50% of the levels were low, 45% within the normal level (WNL), and 5% high. Non-supplemented patients had 90 levels with an average draw time at 14 days and an average serum level of 64mcg/dl. Over all 71% of the levels were low and 29% WNL. Comparing the supplemented and non-supplemented levels there was a decrease of 18% in the non-supplemented levels. (p=0.0002) Supplemented manganese patients had 562 levels with an average draw time of 14 days and average whole blood level of 13.8 mcg/L. Seven percent were low, 66% WNL, and 27% high. There were 36 levels in the non-supplemented patients with an average draw time of 32 days and serum level was 15.2 mcg/L.

Eight percent were low and 50% WNL, and 42% were high. Comparison showed an increase of 2% in the non-supplemented levels. ($p=0.0983$) Supplemented selenium patients had 109 levels drawn with an average draw time of 20 days and average serum level of 48.5mcg/L. Patients with low levels equaled 22%, 77% WNL, and 1% were high. There were 57 levels in the non-supplemented group with an average draw time of 19 days and the serum level was 51mcg/L. Levels WNL equaled 93% WNL and 7% were low.. There was no statistical difference between groups concerning serum selenium levels ($p=0.2973$). Supplemented iodine had 255 levels drawn with an average draw time of 23 days and average urine iodine level of 109mcg/L. Patients with low levels equaled 61%, 39% within the WNL. There were 176 levels in the non-supplemented with an average draw time of 16 days and the average urine level was 73 mcg/L. Patients with low levels equaled 76% and 24% WNL. There was a statistical difference between groups concerning urine iodine levels ($p=0.0005$).

Conclusion: Copper is added to the PN formula and serum level assessed at 14 days to adjust the dose for patients outside of normal levels. Manganese, selenium and iodine should not be supplemented initially. Patients receiving PN greater than 14 days should have manganese , selenium and iodine levels assessed and if low added to the PN formula.

Category: Pediatrics

Title: Incidence and risk factors associated with iron deficiency anemia in hospitalized Lebanese infants

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Purpose: Iron deficiency (ID) is the most prevalent nutritional deficiency worldwide, and Iron deficiency anemia (IDA) results in major adverse consequences on health and development. The prevalence of anemia in Lebanon is moderate. However, data about incidence and risk factors of IDA in the Lebanese pediatric population is scarce. The objective of the current study was to detect the prevalence of IDA and associated risk factors in hospitalized Lebanese infants aged 6-24 months and to compare the findings between rural and urban areas.

Methods: A prospective multicenter cross-sectional study was conducted in pediatrics departments of three Lebanese hospitals from December 2012 to May 2013. Two hospitals were in rural areas and one was in an urban area. Male or female, term or preterm infants within the age of 6 to 24 months were included. Infants with G6PD deficiency, sickle cell anemia, thalassemia, chronic infections, congenital immunodeficiency and mental or congenital growth retardation were excluded. Among 520 screened infants, a total of 100 patients were selected. Incidence of IDA was assessed using hematologic laboratory findings from patients charts. A cutoff value of 11 g/dl of hemoglobin was used to indicate mild anemia, while a value between 7-10 g/dl was used to define moderate anemia. To assess risk factors associated with IDA, questionnaires addressed to infants caregivers were used. Questions included: infant demographics, gestational age at delivery, frequency of hospital admission, exclusive breastfeeding duration, age of introduction of infant formula and weaning food, intake of cow milk and vitamin C, and iron supplementation. Maternal factors were also addressed including health status, iron intake, and educational level, as well as family income and health resource accessibility.

Results: Thirty seven percent of patients were anemic, with 18% complaining from mild anemia and 19% with moderate anemia. Among non-anemic infants, 24% have a lower limit value of hemoglobin (11-11.5 g/dl). Percentages of risk factors prevalence among infants were almost similar between urban and rural areas. Lower percentages of resource availability, maternal education and adequate family income were detected in rural areas. Infants of families with low income were at higher risk of having anemia compared to higher socioeconomic status (95% CI, 0.19-0.98; $p=0.045$). Other significant risk factors include: inadequate maternal iron supply (95% CI, 1.01-8.26; $p<0.047$), low maternal educational level (95% CI, 0.07-0.88; $p=0.03$), residing in rural areas (95% CI, 0.064-0.0509; $p<0.001$), lack of infant iron supply (95% CI,

1.39-8.41; $p=0.007$) and exclusive breastfeeding for more than 6 months (95% CI, 0.99-8.68; $p=0.052$). Non-significant risk factors were: cow milk intake, vitamin C intake, age of formula introduction and age of weaning food. No statistical significance was detected in hemoglobin levels between males and females or term and preterm infants.

Conclusion: Incidence of IDA among Lebanese infants is moderate and multifactorial. High maternal educational level, urban residence, exclusive breastfeeding up to 6 months duration, adequate family income and iron supplementation in both mother and infant are significant protective factors against anemia in this population.

Category: Pediatrics

Title: Medication errors in prescribing, dispensing, and administration of medicines to the child patients in Hamamatsu University Hospital

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Purpose: Medication incidents to child patients often happen in health system in Japan. The influence of patient characteristics on medical errors is rarely clarified. The aim of this study was to evaluate characteristics of medication errors in prescribing, dispensing, and administration of medicines to the child compared with adult patients.

Methods: Medication errors which occurred in prescribing and dispensing of medicines in Hamamatsu University Hospital in Japan from August 2010 to July 2011 were collected. Characteristics of these errors to child were compared to adult patients. Medication incidents in pediatric ward were also collected.

Results: The total number of inpatient-days was 182,284 during the study period. Child patients consisted of 5.9% of them. The number of prescription errors was 1089. Prescription to the child patients accounted for 11.4% of them. The most frequent prescription errors were on dosage for child but on directions for adult patients. The number of dispensing error was 984. Dispensing error was most often occurred when compounding medicines prescribed for child but in counting for adult patients. The number of medication incidents occurred in pediatric ward was 156. The most frequent medication incidents were removing nasogastric or intravenous tubes by him- or herself. Medicine-related errors accounted for 32.1% of all incidents in pediatric ward.

Conclusion: Errors in prescriptions to child were more frequent than to adult patients. Most frequent error was on dosage in prescription to child patients. Dispensing error was most often occurred when compounding medicines for child patients. Errors related to medicines for child were different from those for adult patients, and their countermeasure should be separately provided.

Category: Pediatrics

Title: Evaluation of the effectiveness of a new vancomycin dosing guideline in the University of Colorado Hospital neonatal intensive care unit for achieving therapeutic trough concentrations

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Purpose: In 2009, ASHP, IDSA, and SIDP published a consensus guideline for vancomycin therapeutic drug monitoring. The guideline recommended a higher therapeutic range, with avoidance of trough concentrations below 10 mcg/mL to prevent emergence of resistance. In September 2010, the neonatal intensive care unit (NICU) began utilizing a more aggressive vancomycin dosing guideline to achieve recommended therapeutic trough concentrations between 10-20 mcg/mL. The purpose of this study was to evaluate the effectiveness of the new dosing guideline in achieving therapeutic trough concentrations compared to the previous dosing regimen.

Methods: The institutional review board approved this retrospective cohort study. Neonatal ICU patients who had a vancomycin trough concentration obtained under the new dosing guideline (between September 2010 and December 2011) were placed into the new guideline cohort. Patients who had a vancomycin trough obtained according to the old guideline (between January 2009 and August 2010) were included in the old dosing guideline cohort. Patients who received a diagnosis of hydrops or who were not dosed according to the guidelines were excluded from this study. The primary outcome measure was the change in the percent of neonatal patients who achieved goal therapeutic trough concentrations (10-20 mcg/mL). Secondary outcome measures included: change in percent of neonatal patients who achieve subtherapeutic trough concentrations defined as less than 10 mcg/mL, change in percent of neonatal patients who achieve supratherapeutic trough concentrations defined as greater than 20 mcg/mL, and the change in the percent of neonatal patients who achieve a tight trough concentration defined as between 15-20 mcg/mL. To achieve 80 percent power, it was determined that 90 patients in each group would be needed to detect a 21 percent increase in the number of patients achieving goal therapeutic trough concentrations.

Results: A total of 42 trough concentrations in 39 patients were evaluated in the new vancomycin dosing guideline group and 96 trough concentrations in 65 patients were evaluated in the old vancomycin dosing guideline group. The new dosing nomogram improved the percentage of patients achieving therapeutic trough concentrations (55 percent compared to 27 percent, p equals 0.0034), and decreased the percentage of patients with subtherapeutic trough concentrations (5 percent compared to 72 percent, p less than 0.0001) compared to the old dosing guideline. The percentage of patients with supratherapeutic trough concentrations was increased

in the new dosing guideline group (40 percent compared to 1 percent, p equals less than 0.0001). Trough concentrations of 15-20 mcg/mL were observed in 19 percent of new dosing versus 14 percent old dosing patients, p equals 0.444. Overall, the average total daily dose for patients achieving goal therapeutic trough concentrations was 36 mg/kg with a standard deviation of 12 mg/kg. The average trough concentration achieved was 14.3 mcg/mL with a standard deviation of 2.8 mcg/mL.

Conclusion: Utilization of a more aggressive vancomycin dosing guideline in NICU patients improved achievement of recommended therapeutic vancomycin trough concentrations compared to an old guideline that was designed based upon frequently utilized neonatal drug reference books. Additionally, significantly fewer patients had subtherapeutic trough concentrations. However, the more aggressive vancomycin dosing nomogram resulted in a higher number of supratherapeutic trough concentrations. Further research is needed to establish the clinical significance of these findings and to determine the optimal dosing strategy for gestational age subgroups.

Category: Pediatrics

Title: Evaluation of fixed-dose versus weight-based dosing of morphine sulfate for neonatal abstinence syndrome (NAS): an institutional protocol review

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Purpose: The primary objectives of the study are to evaluate the mean length of hospitalization and duration of therapy of fixed-dose versus weight-based dosing of morphine sulfate for the treatment of neonatal abstinence syndrome (NAS).

Methods: We conducted a retrospective, electronic chart review to identify patients for this study. Institutional review board approval was obtained prior to data collection. Between May and November of 2012 we identified patients who received the fixed-dose protocol. Patients on the weight-based regimen were identified retrospectively between January and August of 2010. The two co-primary endpoints were the mean length of hospitalization and mean duration of morphine therapy between both treatment arms. Secondary endpoints included the average morphine dose and maximum NAS scores between fixed- and weight-based groups. Patients who were included in data analysis had been charted with the ICD-9 code of drug withdrawal syndrome in the newborn, age within the first 30 days of life, had been diagnosed with NAS and started on either protocol and had received at least one dose of study medication. Patients who were missing documentation of symptoms of NAS for two or more days were excluded from data analysis.

Results: A total of 25 patients were assessed for eligibility. Of these patients 13 were excluded from data analysis; these patients were either non-infants or had not received morphine therapy. Therefore 12 patients met inclusion criteria - 6 patients in the fixed-dose group and 6 patients in the weight-based group. Patients were well matched for baseline characteristics including gestational age, gender average admission weight and delivery method. The mean length of hospitalization was 15 days in the fixed-dose group and 18 days in the weight-based group ($p = 0.55$). The mean duration of therapy was similar between both groups (12.2 days and 12.3 days, respectively; $p = 0.98$). There was a statistically significant difference in the mean morphine dose. Patients in the fixed-dose group received an average of 0.11 mg of morphine compared to 0.29 mg in the weight-based group ($p < 0.001$).

Conclusion: There was no significant difference in either length of hospitalization or duration of therapy between groups. We did identify significantly less morphine use in the fixed-dose protocol compared the weight-based group. The limitations of this study include the limited

sample size, the retrospective design that did not account for other medical co-morbidities that may have contributed to the length of stay. As a result, we identified future areas of research may include evaluating the difference in order entry errors and the rates of adverse effects between both groups.

Category: Pharmacokinetics

Title: Optimization of an aminoglycoside nomogram in the obstetric population

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Purpose: Aminoglycosides are used in the treatment of intraamniotic infections pre and postpartum. UAB Hospital currently utilizes a weight-based approach and a larger volume of distribution to determine aminoglycoside dosing. Currently a volume of distribution of 0.3L/kg is being used for empiric dosing. Pharmacists have noticed problems with this dosing method as the dose or interval needs to be frequently adjusted. By analyzing aminoglycoside data retrospectively, it is theorized that a new nomogram can be developed and empiric dosing improved.

Methods: This was a single-center, IRB-approved, retrospective study of obstetric patients treated with aminoglycosides for chorioamnionitis. In this analysis medical records were obtained from postpartum individuals who received orders for gentamicin from July 1, 2011 to July 31, 2012. Records for all patients were reviewed and excluded if blood collection was not adequately obtained or if renal function was abnormal. Equations were used to determine each patients volume of distribution (Vd), elimination rate constant (Ke) and drug clearance (CL). A regression analysis was used to establish what pharmacokinetic factors corrected to predict a new nomogram. The new nomogram was designed to target peak levels of 5-7 mcg/mL and trough levels of <1 mcg/mL. Prior to implementing the new nomogram, assessment of the dosing regimens was performed on the retrospective patient population to ensure production of appropriate peak and trough levels.

Results: A total of 95 patients were included in the analysis. Based on the retrospective study, doses had to be changed in 75% of all cases and were out of range 67% of the time. After all data was collected, a regression analysis was conducted and a strong interaction was predicted with two variables. The first positive correlation existed between the volume of distribution and total body weight (average volume of distribution based on total body weight = 0.23 L/kg). The second positive correlation existed between the volume of distribution and dosing weight (average volume of distribution based on dosing weight = 0.28 L/kg). Using these predictions, two new weight based nomograms were developed and compared. Before implementing the revised nomogram and prospectively examining its effect in actual practice, patient specific pharmacokinetic parameters were used to predict peak and trough levels for the retrospective patient population if they had been dosed using the revised nomograms. It was further demonstrated that the nomogram that utilized the volume of distribution of the total body weight

attained therapeutic peak and trough concentrations 63% of the time, while the dosing weight nomogram attained this at a rate of 56%.

Conclusion: Based on the retrospective study, the new pharmacokinetic parameters will be used to guide dosing in this patient population and prospective data will be collected in order to evaluate new regimen appropriateness. Application of the revised nomogram using the average volume distribution of the total body weight predicted better therapeutic gentamicin peak and trough concentrations compared to current practice methods. By achieving better therapeutic levels, patient outcomes should be improved and issues with toxicity avoided.

Category: Pharmacokinetics

Title: Comparison of the pharmacokinetics of USL255, an extended-release topiramate, when sprinkled onto food or swallowed intact

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Purpose: USL255, a once-daily extended-release formulation of topiramate (TPM), has been developed for the treatment of epilepsy. As some patients with epilepsy may have difficulty swallowing tablets or capsules, USL255 was formulated to allow for oral delivery by opening the intact capsule and sprinkling its small multiparticulate beads onto soft foods. A primary objective of this study was to confirm pharmacokinetic (PK) equivalence between the USL255 beads sprinkled onto soft food compared with the intact USL255 capsule.

Methods: In this phase 1, open-label, single-center, single-dose, crossover study, a total of 36 healthy subjects (aged 18-64 years) were randomized to receive both an intact USL255 200 mg capsule administered under fasting conditions and USL255 200 mg opened and sprinkled onto one tablespoonful of applesauce after an overnight fast; treatment periods were separated with a minimum 3 week washout. Blood samples were collected for 14 days after each dose and standard PK parameters were calculated including area under the plasma concentration-time curve (AUC_{0-t} and AUC_{0-inf}), maximum plasma concentration (C_{max}), time to maximum plasma concentration (T_{max}), and terminal elimination half-life (t_{1/2}). Pharmacokinetic equivalence between administration methods was evaluated; AUC and C_{max} values were considered equivalent if the ratio of the geometric least-squares mean (GLSM) values had a 90% confidence interval (CI) between 0.8 - 1.25. Safety and tolerability were evaluated through the collection of adverse events (AEs), vital sign measurements, ECGs, and clinical laboratory evaluations.

Results: Total TPM plasma exposure (AUC) was equivalent between USL255 200 mg administered as an intact capsule and sprinkled onto soft food (GLSM [90% CI]: AUC_{0-t}, 1.01 [0.97 - 1.04]; AUC_{0-inf}, 1.02 [0.98 - 1.05]). Additionally, equivalence between the intact capsule and sprinkled beads was established for C_{max} (GLSM [90% CI], 1.09 [1.03 - 1.14]), and t_{1/2} was similar for both administration methods (81.5 hr intact vs. 83.6 hr sprinkled). Median T_{max} for USL255 was between 10 - 14 hours. USL255 200 mg was generally well tolerated, with similar types and numbers of AEs reported between both groups. The most commonly reported treatment-emergent AEs were nausea, dizziness, headache, and paraesthesia. One serious adverse event of anemia was reported 15 days after USL255 dosing, but was deemed unrelated to study treatment.

Conclusion: USL255, when sprinkled onto soft food, demonstrated pharmacokinetic equivalence for both AUC and C_{max} when compared with the intact capsule. Therefore, USL255 can be a beneficial treatment option for the management of epilepsy and provides additional value for individuals with difficulty swallowing whole capsules or tablets.

Category: Pharmacy Technicians

Title: Using lean process improvement methodology to improve medication delivery times to inpatient units in a community hospital setting

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Purpose: Timely delivery of medications is of utmost importance in ensuring patients receive the medications they need, when they need them. Annual satisfaction surveys, of our nursing departments, revealed that there was a sustained concern around the time it took to have medications available on the inpatient unit. Pharmacy technicians also reported frustration in the level of phone calls they received, from nursing, looking for unavailable medications. Therefore, the Pharmacy department, with a process improvement facilitator, examined current roles and responsibilities of pharmacy technicians, with the goal of streamlining workflow and establishing a consistent run schedule.

Methods: The Pharmacy Department formed an internal team (director, managers, front-line staff) to work with a process improvement facilitator. With a focus on the role of the technician runner, three days were spent using the DMAIC (define, measure, analyze, improve, control) framework to create a process map for how the pharmacy was preparing and distributing medications for delivery to the floors (both for placement in automated dispensing machines and patient-specific medications delivered to medication rooms on the nursing floors). In scope for the project was a review of technician activity from 0700 to 1530, Monday through Friday, excluding IV preparation. Over three days, the team created a process map, gathered metrics, defined pain points, looked at root causes and brainstormed solutions. By utilizing tools such as benefit-effort mapping, the team was able to identify those steps which would require little effort yet yield high benefit (quick wins). It was felt by the team that, after implementation of these quick wins, the role of the technician runner would be sufficiently streamlined such that it would be possible to make runs to each of the units, beginning every hour on the half-hour. On 4/16/13, hourly runs were instituted 0700 1500, Monday thru Friday.

Results: The process map showed 13.5 hours worth of work expected within a 7.5 hour shift. After removing non-essential tasks, the shift was reduced to an expectation of 7 hours of work. Baseline medication order turnaround time {TAT} (defined as from physician order entry to availability on the nursing unit) for 3/1/13 3/31/13 was 85 minutes and for 4/1/13 -- 4/16/13 was 100 minutes. In the post-intervention period, TAT for 4/17 4/30/13 was 74 minutes and for 5/1/13 through 5/31/13 was 80 minutes. Data will continue to be analyzed through at least July

2013, but there is already a trend down in TAT, on the order of 16.5% (average of 92.5 minutes pre-intervention to average of 77 minutes post-intervention). Baseline data, collected 03/25/2013- 04/14/2013, showed that pharmacy received an average of 57 calls during the 0700 1530 shift, Monday through Friday. Go-live date for hourly runs was April 16, 2013. Data collected that day and for the following week showed a 66% reduction in phone calls (to 19). Most of the phone calls, received during this shift, are typically from nurses looking for medication doses. And so this significant reduction further demonstrates nursing's increased ability to access needed medication doses.

Conclusion: By utilizing a systematic approach to process improvement, delivery times for medication can become a standardized process that decreases delays in delivery, increases nursing satisfaction and improves patient care. Opportunities for continued improvement include better quality assurance of the bar-coding formulary for the carousel and expansion of technician hourly runs to 24/7/365.

Category: Pharmacy Technicians

Title: Impact of two pharmacy technicians on the medication reconciliation process at our institution

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Purpose: Medication reconciliation helps to reduce medication errors in the hospital, and patient interviews are a key part of the medication reconciliation process. Although it would be ideal for clinical pharmacists to complete all of the patient interviews, they have numerous competing responsibilities. Two pharmacy technicians were hired in late 2011, and were trained to extract medication histories from the patient's chart, complete a patient interview to verify the history, and document their findings as a note in the medical record. This study aimed to assess the impact of the two pharmacy technicians on the medication reconciliation process at our institution.

Methods: This study was approved by the institutional review board. The impact of the pharmacy technicians was assessed retrospectively by evaluating the presence or absence of Medication History, Medication Reconciliation, and Discharge Counseling Notes in the medical record by pharmacists and technicians from March 13, 2011 to June 12, 2011 (prior to implementation of the technicians) and from March 13, 2012 to June 12, 2012 (after their implementation). The time from admission to completion of the Medication Reconciliation Note was also collected. Descriptive statistics were used to summarize the differences between these measures before and after the implementation of the technicians. Discrepancies between the medication history obtained by the technician and that obtained by the provider were also categorized and tallied.

Results: The percentage of patients discharged from the medicine or surgery services at our institution who had a completed pharmacist Medication Reconciliation Note increased from 31.6 percent in 2011 to 81.9 percent in 2012 (p less than 0.001). The number of Medication Reconciliation Notes per pharmacist full-time equivalent (FTE) increased from 27.9 (2011) to 51.3 (2012). The percentage of patients who were interviewed regarding their medication history increased from 37.4 percent in 2011 to 78.3 percent in 2012 (p less than 0.001). The percentage of patients with a Discharge Counseling Note also increased from 29.7 percent to 40.4 percent (p equal to 0.003). The number of patient interviews per FTE and the number of Discharge Counseling Notes per FTE remained similar before and after the implementation of the pharmacy technicians. The time between admission and completion of the Medication Reconciliation Note decreased after implementation of the technicians, from 3.1 days in 2011 to

1.6 days in 2012. The most common discrepancy type between technician Medication History Notes and provider medication histories was a missing or incorrect dosing schedule, followed by dose omission, and drug omission.

Conclusion: Implementation of the technicians enabled pharmacists to complete more admission Medication Reconciliation Notes. Pharmacy technicians contributed to pharmacist efficiency by decreasing the time between hospital admission and completion of the Medication Reconciliation Note and enabled more patients to be interviewed. Technician medication histories were more complete than those collected by providers.

Category: Pharmacy Technicians

Title: Pharmacy technician rounds: Keeping up the pace in the intensive care units.

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Purpose: The Pharmacy Practice Model Initiative calls for expanding the roles of pharmacy technicians to free pharmacists from drug distribution activities. The pharmacy technicians at our institution are all registered with the state and have passed the PTCB exam. This poster describes the function of our technicians in the intensive care units, specifically looking at their rounding responsibilities.

Methods: Two shifts of pharmacy technicians staff in the intensive care units. Pharmacy technicians usually round once per shift in the various Medical, Cardiac and Surgical Intensive Care Units. Each technician covers a number of units during a given shift. On these rounds, part of the technicians responsibilities is to evaluate the intravenous piggybacks (IVPB) and infusions for correct drug, diluents, strength and expiration date of bag, volume remaining, current rate and time next bag is due. Also, they are to evaluate any missing IVPB doses. The technicians then make interventions as appropriate. Interventions from these rounds have been collected and evaluated.

Results: Pharmacy Technicians evaluate hanging intravenous medications in the Medical, Cardiac, and Surgical Intensive Care patients during their daily rounds. During these rounds, technicians evaluate 4-10 patients per unit, each with 1-12 intravenous medications. Rounds typically take 90 minutes for all of their activities and units, but may last over 120 minutes when issues arise. Intravenous infusions are evaluated for: right patient, right medication, right dose/concentration, and appropriate expiration dating. On these rounds, the most common issues that arise are expired medication (i.e., infusion bags older than 24 hours), correct patient, and wrong rate. To address the expired medications, our first step is to verbally communicate with the nurse. However, one technician started leaving informal written communications with the nurses concerning when medications will expire. Due to this intervention, there has been a decrease of 75% of expired medications.

Conclusion: Rounding of pharmacy technicians in the intensive care area allows for improving patient care by catching a number of medication errors or potential errors. In addition, the time that the technician spends frees up time for the pharmacist to be involved in additional patient care activities.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Ticagrelor vs. clopidogrel for treating acute coronary syndrome (ACS) in patients with diabetes mellitus: an incremental cost-effectiveness analysis

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Purpose: Results from the PLATO trial show that ticagrelor significantly reduces the composite endpoint of cardiovascular death, myocardial infarction, or stroke in patients with acute coronary syndrome compared to clopidogrel. A sub-study from the PLATO trial highlights that patients with acute coronary syndrome and diabetes have a higher risk of cardiovascular events, adverse outcomes, and mortality. Economic evidence suggests that ticagrelor may be cost-effective in treating patients with acute coronary syndrome compared to clopidogrel. However, data are lacking for the high-risk diabetes population. A cost-effectiveness analysis in this patient population is warranted, particularly due to the recent generic availability of lower-cost clopidogrel.

Methods: A Markov model was used to run a cost-effectiveness analysis based on health outcomes and event rates from the PLATO trial and pertinent sub-studies. Patients with ACS and diabetes in the model are treated with either ticagrelor, or the current standard of clopidogrel, and aspirin for 12 months. Long term analyses are based on event rates occurring during the initial year of treatment. Outcomes of this analysis include life-years gained and direct medical costs of treatment from a third-party payer perspective. All costs and event rates are adjusted to reflect current and future values. Two-way sensitivity analyses and Monte Carlo simulation are utilized to explore uncertainties related to the input parameters.

Results: The base-case analysis reveals that ticagrelor is associated with an incremental effectiveness of 0.1126 life-years gained and an incremental cost of \$32.77 compared to clopidogrel. This corresponds to an ICER of \$291.11 per life-year gained. Sensitivity analyses were consistent with base-case results for plausible clinical expectations. Probabilistic sensitivity analysis indicates, in a majority of iterations, that ticagrelor is cost-effective based on a willingness to pay of \$50,000 per life-year gained.

Conclusion: Ticagrelor is a cost-effective option in treating patients with ACS and diabetes compared to clopidogrel. Base-case results reveal an ICER that is well under the accepted threshold of cost per life-year gained. The Monte Carlo simulation shows that variations of the

inputs associated with treatment are unlikely to have a notable effect on these findings. For this analysis, all clinical inputs are dependent on the results of the PLATO trial. Further analyses are warranted as ticagrelor becomes a more widely used treatment option.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost-effectiveness of screening for metformin-associated vitamin B-12 deficiency and supplementation in patients with type 2 diabetes

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Purpose: Metformin is one of the most commonly used oral antihyperglycemic agents in type 2 diabetes (T2DM). New evidence suggests an association between long-term metformin therapy and vitamin B-12 deficiency, which can result in costly complications, such as peripheral neuropathy and megaloblastic anemia. These complications can be mitigated by early screening or preventative supplementation. This analysis evaluates the cost effectiveness of screening for vitamin B-12 deficiency over a lifetime horizon from a third party payer perspective, compared to prophylactic supplementation with vitamin B-12 and symptomatic treatment in patients with type 2 diabetes on metformin therapy living in the United States (US).

Methods: A decision analysis using a Markov model was performed in a hypothetical cohort of 50 year-old patients with T2DM to estimate the cost-effectiveness of alternative screening and treatment strategies of vitamin B-12 deficiency secondary to metformin therapy. The economic evaluation was conducted from a third-party payer perspective in the US using a lifetime horizon. Strategies consisted of screening, preventative therapy, and usual care. The screening intervention included annual testing with a serum vitamin B-12 test and a serum MMA test and, in those deemed deficient, correction of deficiency (<200 pg/ml) with B-12 supplementation. Preventative treatment with vitamin B-12, without screening, was also compared to the usual care strategy of symptomatic treatment with vitamin B-12. The dose of vitamin B-12 across all strategies was 1000mcg injected subcutaneously once per month. Clinical effectiveness parameters, including vitamin B-12 deficiency incidences and major complication probabilities (peripheral neuropathy and megaloblastic anemia), were derived from clinical trials. A macro-costing approach using valuations from published literature was adopted. Costs were adjusted for inflation to 2013 USD. Outcomes were quality-adjusted life-years (QALYs), lifetime cost and incremental cost-effectiveness ratio (ICER). Costs and QALYs were discounted by 3% annually. One-way sensitivity analyses were performed testing the robustness of the results.

Results: Both screening and preventative therapy were dominant over usual care, indicating that the latter was relatively more expensive and less effective. The ICER of screening for the deficiency versus preventative therapy was \$2,164 per QALY. The base case analysis showed that although screening was more expensive than preventative therapy (\$4,186 vs. \$3,995), it

was also more effective (11.98 QALY vs. 11.89 QALY). The findings were robust to varying parameter values under one-way sensitivity analyses.

Conclusion: Usual care with symptomatic treatment of vitamin B-12 deficiency is associated with higher costs and less favorable outcomes compared to both screening and preventative treatment interventions. The results of the base case analysis suggest that screening for vitamin B-12 deficiency in patients with T2DM on metformin therapy is a cost effective strategy compared to preventative vitamin B-12 supplementation.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Re-engineered pharmacy services improves the medication reconciliation (MR) process and meets meaningful use objectives at a community hospital

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Purpose: Studies have shown admission to and discharge from hospitals put patients at risk for medication discrepancies. Medication reconciliation is a formal process to uncover and correct these discrepancies. The Joint Commission requires MR. The Federal government has made orders reconciliation a core item for Stage 2 Meaningful Use. Recently this 315 bed hospital purchased software to automate the MR process. These factors led the hospital to charter a Performance Improvement (PI) team to improve the MR process and guide configuration and implementation of the software product. This report describes the role of pharmacy services and outcomes.

Methods: The PI team focused on process change to obtain the home medication list within four hours of admission. The pharmacy job of MR specialist was created. The primary location of pharmacy service was determined to be the emergency department which generates 65% of the inpatient admissions. Secondary locations of service are inpatient units to obtain lists from directly admitted patients. Review of records determined how many MR specialists, which included nurses, were needed and hours of day required for pharmacy to provide the majority of this service. Two nurses were included in this re-engineered pharmacy service and three new pharmacy technicians were hired for a total of 4.5 full time equivalent employees. The pharmacy MR specialists were trained to collect and complete the home lists. The pharmacy MR team and all nurses in nursing services were trained on the software to enter the home list. As software configuration progressed a second focus for the team became producing the discharge reconciliation medication list for patients. The need for backup to physicians for discharge MR was recognized and staff pharmacists were included in software set up, training, and perform this function on behalf of physicians when needed.

Results: The re-engineered process and new software were implemented February 2013. The complete home list of medications is collected by the pharmacy MR team for an average 75% of all inpatient admits. The list is collected within 4 hours for the 67% of inpatient admissions from the emergency department, 39% complete at 4 hours for direct admits. The pharmacy MR team has a higher home list completion rate then others trained for this function. This provides prescribers with a complete medication history for admission orders. Short operating room turnaround times present an impediment to surgeons for completing discharge MR for outpatient surgery patients. Pharmacists currently complete the discharge reconciliation for most of the outpatient surgery patients and continue to assist other physicians when needed for the discharge medication reconciliation process. The stage two orders reconciliation goal of 50% for inpatients has been exceeded each month since implementation.

Conclusion: Pharmacy services can play a significant role in helping a community hospital achieve medication reconciliation and meaningful use objectives.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Pharmacy intervention on reduction of early readmission rate in COPD patients

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Purpose: To evaluate if Chronic Obstructive Pulmonary Disease (COPD) education by a pharmacist reduces 30 day readmission rate in COPD patients. This study also assessed the appropriateness of discharge medications; improvements in medication compliance, vaccination adherence, and medication knowledge.

Methods: This is a randomized, prospective study comparing outcomes of patients who received detailed COPD education by pharmacists to patients in control group. Subjects were identified by their COPD diagnosis in the electronic health record. The study included patients who had been admitted for 24 hours with a history of COPD, new diagnosis of COPD, or exacerbation of COPD. Exclusion criteria were patients with co morbid conditions, which have greater clinical priority. For example, patients admitted to intensive care units were excluded until they were transferred to a medical floor. After randomization, the intervention group received extensive teaching from a pharmacist on safe and effective use of medication and successful management of COPD. The control group received standard of care medication reconciliation, daily profile review and discharge counseling. Thirty days after discharge, patients were contacted via telephone to evaluate thirty-day readmission along with a verbal questionnaire to assess medication compliance, vaccination adherence and medical knowledge.

Results: A total of twenty patients were enrolled. Seven patients were randomized into treatment group and thirteen patients were included in control group. Baseline characteristics of patients in both groups were balanced. All twenty patients identified themselves as former smokers. Among thirteen patients in control group, 30 day readmission to hospital was observed in three patients. All seven patients from treatment group did not get readmitted to any hospital within 30 days. COPD education by pharmacists reduced 30 day readmission rate by 23% (ARR, p=NS).

Conclusion: There appears to be a trend towards lowered 30 day readmission rate in patients who received detailed COPD education by pharmacists, however, this did not reach statistical significance. Therefore, a larger study needs to be conducted to validate a true effect of pharmacy intervention. At Cleveland Clinic Florida, current COPD study will continue to enroll patients until predetermined power is reached.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Injectable medication errors in the acute care setting: A descriptive retrospective database analysis.

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Purpose: Injectable medication errors in the acute care setting pose a significant clinical and economic burden to organizations. We conducted a retrospective database analysis of injectable medication errors using records from a national self-reported medication errors system. The purpose of this analysis is to understand trends in injectable medication error rates in order to inform quality improvement efforts.

Methods: The MedMarx national medication errors reporting system holds over 1.2 million anonymously reported records from 860 U.S. institutions. Only inpatient records for errors associated with injectable medication administration during the years 2004 - 2011 were selected from the MedMarx database. Injectable medication error records were defined as those with a route of administration: subcutaneous, intravenous (IV), intramuscular, or epidural, and other. For each type of administration route, records were analyzed for error severity. The severity ranking is standardized in the MedMarx form with categories ranging from A (capacity to cause error) to I (error resulted in death). Severity categories C to I are errors that reached the patient and E to I are those that resulted in patient harm. Trends in type of error severity (proportion of errors that reach patient and cause patient harm, each year) for each type of route of administration were observed over the data period. Ranges represent the low and high limits of annual proportions of all injectable medications in a given year, over the study time period.

Results: 147,463 records were identified as inpatient injectable medication errors between 2004 and 2011. The majority (65-67%) of errors reached the patient, while 2.2% - 2.8% of errors caused patient harm. For 2004-2011, the majority (78.5% - 81% of all errors) of injectable drug errors were administered by the IV route. Between 59.4 - 66.6% of IV medication errors reached the patient, and 2.1% - 2.8% of IV errors caused harm. Subcutaneous injectable drug errors contributed to 13.6% - 16.4% of all errors. Between 62% - 70.9% of subcutaneous errors reached the patient, while 2.8% - 3.8% of errors cause patient harm. Intramuscular injectable drug errors contribute between 3.5% and 5.1% of all errors. Between 54.2% - 65% of subcutaneous injection errors reach the patient, while 0.2% - 2.4% of errors cause patient harm. Epidural drug errors contribute between 0.5% - 0.9% of all errors. Among epidural errors, 25.2% - 73.4% of errors reached the patient, and 1.9% - 8.9% caused patient harm. Among all routes of administration, the proportion of errors that both reached the patient and caused patient harm did not change significantly over the study time period.

Conclusion: Among all injectable medications, the IV administration route is most impacted by frequency of errors and epidural administration is associated with the most harm. The proportion of errors that are impacting the patient has remained largely unchanged, indicating that novel quality improvement strategies are required to improve patient safety. Although only a small portion of errors cause harm, a majority of errors do reach the patient. Prevention efforts should aim to reduce all errors because of the potential for harm. The implementation of systemic changes designed to reduce error opportunities warrants further research to avoid unnecessary clinical and economic consequences.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Evaluation of the cost-effectiveness of tofacitinib therapy in the treatment of patients with established rheumatoid arthritis and an inadequate response to methotrexate alone: a third-party payer perspective

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Purpose: Biologic agents effectively treat rheumatoid arthritis (RA) and maintain remission in patients achieving an inadequate response to first line non biologic disease modifying anti rheumatic drug (DMARD) therapy. Tofacitinib, an oral Janus Kinase (JAK) inhibitor, is the newest and only oral biologic agent available for the treatment of patients whose symptoms were inadequately controlled on methotrexate. The aim of this study was to determine the cost effectiveness of add on tofacitinib therapy for the treatment of RA in patients whose symptoms were inadequately controlled with methotrexate monotherapy from a third party payers perspective.

Methods: A Markov model was constructed to determine the effect of add on tofacitinib and etanercept on the number of quality adjusted life years (QALYs) gained by a cohort of 45 year old patients with established RA and an inadequate response to methotrexate alone. The model had a lifetime horizon spanning 57 years with a cycle length of 3 months. Direct costs, excluding medications, were based on published studies and adjusted to 2012 \$US. Prescription medication costs were based on a large, national private pharmacy chains supplier prices. Patient responses to the different strategies were determined by the American College of Rheumatology (ACR) 50 criteria results obtained from clinical trials. Patients cycled through transition states based on ACR50 criteria, adherence probability, and mortality probability. Adherence was estimated based on published studies. The total 2008 US population life table, adjusted for the increased mortality among RA patients, was used to determine the probability of death. Costs and QALYs were discounted at a rate of 3% per year. One way sensitivity analyses of prescription costs, utility scores, ACR50 criteria, and adherence rates were performed to test the robustness of the base case scenario. Primary results were presented as incremental cost effectiveness ratios (ICERs).

Results: Add on etanercept therapy resulted in an incremental cost of \$480 and an incremental effectiveness of 0.038 QALYs gained compared to add on tofacitinib therapy. This corresponds to an ICER of \$12,692 per life year gained with add on etanercept treatment. Based on a willingness to pay (WTP) of \$50,000 add on etanercept was the cost effective option. Our base

case results were sensitive to fluctuations in all input variables with ICERs ranging from \$8,169 to \$15,193. Nonetheless, etanercept remained the cost effective option for all clinically plausible scenarios evaluated. As shown by the tornado analysis, the ICER was most influenced by etanercept and tofacitinib prescription drug costs. The threshold analysis of tofacitinib prescription cost revealed that the two strategies were equivalent when the cost of tofacitinib was less than or equal to \$6,492.

Conclusion: In this cost utility analysis, the base case results revealed add on etanercept to be cost effective for patients with RA whose symptoms were inadequately controlled by methotrexate alone. Using a threshold analysis, add on tofacitinib was equivalent to add on etanercept when the cost of tofacitinib was decreased. Precise model inputs were difficult to determine due to the limited data available. Therefore, the analysis relied on clinical and cost assumptions. Due to the uncertainty of the inputs, conservative sensitivity analyses were performed. In light of these results, further research is needed to define tofacitinib's place in treatment of RA.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost of treatment for patients treated with disease modifying therapies (DMTs) for relapsing-remitting multiple sclerosis (RRMS): a 2-year analysis from a US payer perspective

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Purpose: Substantial financial burden results from multiple sclerosis (MS) and its treatment. DMTs for patients with RRMS have demonstrated efficacy in reducing relapse rates and delaying disability progression. In addition to positive humanistic and clinical outcomes associated with DMTs, economic considerations are also important. Teriflunomide was recently approved in the US for the treatment of RRMS. A pivotal phase 3 trial showed teriflunomide 14mg significantly reduced relapses by 31.5 percent (p less than 0.01) and 12-week confirmed disability progression by 29.8 percent (p equals 0.03) vs placebo. This analysis compares 2-year costs for RRMS patients treated with teriflunomide vs other DMTs.

Methods: An Excel-based spreadsheet model was developed to evaluate disease- and treatment-related costs of care for RRMS patients. The model was based on a design used in a previously published economic evaluation in RRMS and was populated with results from a Bayesian mixed treatment comparison (MTC) of teriflunomide 14mg to all other DMTs currently approved for RRMS in the US [subcutaneous (SC) and intramuscular (IM) interferon beta-1a, SC interferon beta-1b, glatiramer acetate, natalizumab, fingolimod, and BG-12]. Given the short time horizon of the model, we assumed treatment had no impact on costs associated with disability progression. The benefits of treatment were limited to their effects on relapse rate and on the proportion of relapses requiring hospitalization. Teriflunomide data were derived from The Randomized Trial of Oral Teriflunomide for Relapsing Multiple Sclerosis (TEMSo; NCT00134563). Data for the other DMTs were derived from published literature. Costs per patient were calculated based on Expanded Disability Status Scale (EDSS) state, rates of relapses leading to and not leading to hospitalization, DMT wholesale acquisition costs (WAC), drug administration and monitoring costs, and treatment-related adverse events. The analysis assumes a US payer perspective over a 2-year time horizon.

Results: Two-year total costs (disease-related costs, DMT costs, drug administration and monitoring costs, and treatment-related adverse event costs) were lowest for teriflunomide 14mg patients at 120,723 dollars per patient. Costs were highest for patients treated with fingolimod at 143,204 dollars per patient. Interferons, glatiramer acetate, natalizumab, and BG-12 were associated with higher costs than teriflunomide although lower costs than fingolimod, ranging from 124,641 to 134,930 dollars per patient. Variability of costs of therapy across DMTs was largely driven by differences in drug acquisition costs (49,455 dollars per year for teriflunomide to 60,423 dollars for fingolimod). Variability in medical costs across DMTs was attributable to

differences in rates of relapse (0.31 for natalizumab to 0.78 for IM interferon beta-1a), relapses requiring hospitalization (4.0 percent for glatiramer acetate to 14.3 percent for natalizumab), and drug administration costs (0 dollars for all therapies except natalizumab at 3,302 dollars per year).

Conclusion: Among RRMS patients treated with an approved DMT in the US, 2-year costs of treatment are lowest in patients treated with teriflunomide 14mg, largely due to its lower WAC. Because of the relatively low number of relapses experienced by patients per year and modest differences in relapse rate reduction across the DMTs, with the exception of natalizumab, differences in the impact of DMTs on relapse-related costs over the two-year time horizon were small. Differences may be more substantial over longer time horizons, particularly when the benefits of delaying progression to costly disease states are realized.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Outcomes comparison of dexmedetomidine vs. propofol in a large, tertiary care teaching hospital

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Purpose: Over the past several years, multiple studies have been published comparing dexmedetomidine to other agents used for ICU sedation. Although the results vary, the studies have generally indicated an equivalent amount of ventilator days as compared to patients on propofol. This particular result is concerning, particularly since the proposed cost savings seen with dexmedetomidine over midazolam is driven by shortened ventilator days. However, it is unclear if these results would be applicable in the real-world setting. For this reason, an outcomes analysis was undertaken at a large tertiary care hospital.

Methods: Using the UHC and Premier CareScience outcomes databases, a retrospective comparison was conducted using all patients that had received propofol or dexmedetomidine in the ICU of a large, tertiary care teaching hospital during a 6 month period from October 2011 to March 2012. Data was extracted on patient demographics, mortality, complications, length of stay, and ventilator days.

Results: During the selected timeframe, 607 patients were identified that had received propofol only and 38 had received dexmedetomidine only. The dexmedetomidine and propofol patient populations appeared to be similar in terms of acuity based on case mix index (CMI), with CMIs of 5.52 and 5.65 respectively. The ICU length of stay was approximately 1 day shorter for the dexmedetomidine group (4.19 days vs. 5.17 days), although there was no impact seen on overall hospital length of stay. The use of dexmedetomidine was also associated with significantly less mortality (7.89% and 11.53%), as well as significantly fewer ventilator days (1.89 days vs. 6.89 days).

Conclusion: In this large, tertiary care, teaching hospital, the use of dexmedetomidine was associated with a significantly shorter ICU stay, fewer ventilator days, and lower mortality as compared to propofol. Although patient case mix indices were similar between the dexmedetomidine and propofol groups, due to the limitation of the outcomes database, it is difficult to ascertain if there were specific patient characteristics that led to one agent being prescribed over the other. More patient-specific evaluation is needed to determine this information.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Association between initial days supply of angiotensin II receptor blockers and hospitalization and health-care resources utilization

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Purpose: To evaluate the relationship between angiotension II receptor blocker (ARB) initiation with a 30- versus 90-day supply, hospitalization events and healthcare resource use.

Methods: This retrospective cohort study used data from the MarketScan Commercial Claims and Encounters and Medicare Supplemental Databases. Patients aged ≥ 18 years with a diagnosis of essential hypertension (ICD-9 code 401.xx), who were newly initiated on ARBs as a 30 or 90 days supply prescription between January 1, 2007 and March 31, 2011 were identified and followed for nearly a year (360 days) after the index ARB prescription. Outcome estimates included adherence (as proportion of days covered (PDC)), suboptimal adherence (PDC <80%), rate of discontinuation (31 or more consecutive days without a refill), risk of hospitalization, and number of inpatient, outpatient, and emergency room (ER) visits. Cox proportional hazards models adjusted for age, sex, and previous hospitalization were used to assess associations between: (a) initial days supply and drug (ARB) discontinuation, and (2) initial days supply and hospitalization.

Results: Patients initiated on a 90-day supply of ARBs had a higher average PDC (79.9% [95% confidence interval (CI): 79.8-80.0] vs. 63.7% [95% CI: 63.7-63.8]) and less frequent suboptimal adherence (53.2% [95% CI: 53.1-53.4] vs. 70.6% [95% CI: 70.5-70.6]). Unadjusted discontinuation rate was lower in the 90-day group (68.8% [95% CI: 68.6-69.1] vs. 82.4% [95% CI: 82.2-82.5]) compared to patients initiated on a 30-day supply; with adjusted hazard ratios (HR) [and 95% CI] of: 0.80 [0.77, 0.83] ($p < 0.0001$) and 0.79 [0.78, 0.80] ($p < 0.0001$) for both patients with and without previous hospitalization respectively. Patients initiated on a 90-day (vs. a 30-day) supply had fewer hospitalizations for both patients with and without previous hospitalization, with adjusted hazard ratios (HR) [and 95% CI] of: 0.89 [0.86, 0.93] ($p < 0.001$) and 0.97 [0.95, 0.99] ($p = .031$), respectively. Hypertension-related health resource utilization rates per 100 patients were lower for the 90-day cohort (than the 30-day cohort) for: inpatient visits (3.8 vs. 4.4, $p = 0.019$), ER visits (4.6 vs. 6.7, $p = 0.011$), and outpatient visits (76.2 vs. 81.5, $p < 0.001$).

Conclusion: Patients initiated on a 90-day supply of ARB showed higher adherence & persistence, had fewer hospitalizations and lower health care hypertension-related resource utilization compared with that of patients initiated on a 30-day supply of ARB.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost-effectiveness of tyrosine kinase inhibitors for the treatment of imatinib-resistant chronic phase chronic myelogenous leukemia

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Purpose: Patients with chronic phase chronic myelogenous leukemia (CP-CML) typically begin treatment with imatinib. However, over time, many patients eventually stop responding to this medication. Alternative tyrosine kinase inhibitors (TKIs), including dasatinib, nilotinib, and ponatinib, can be used when this occurs, but there are currently no cost-effectiveness analyses comparing these three drugs. The objective of this project is to determine the cost-effectiveness of these medications in patients with CP-CML who have become resistant to imatinib.

Methods: This analysis was done from a third party payer perspective, and the population was patients 64 and older with CP-CML who were resistant to imatinib and did not have the T315I mutation. Dasatinib 100 mg daily, nilotinib 400 mg twice daily, and ponatinib 45 mg daily were compared using a Markov model to determine the cost (in 2012 U.S. dollars) per month of life gained. The model accounted for patients being able to remain in the chronic phase of CML or experience disease progression while on these TKIs. It also accounted for the costs associated with treating major adverse events caused by these medications. The measure of benefit was months of life gained on treatment for the incremental cost-effectiveness analysis. One-way and Monte Carlo multi-way sensitivity analyses were conducted with important variables for analyses of uncertainties.

Results: The findings highlighted the incremental value of nilotinib compared with dasatinib as a second-line agent for patients with imatinib-resistant CP-CML who do not have the T315I mutation. Dasatinib extended a patients life by 39.25 months at a cost of \$374,297. Nilotinib extended a patients life by 44.83 months, costing \$513,206. Finally, ponatinib extended a patients life by 44.13 months, costing \$530,428. Nilotinib dominated ponatinib. The ICER for nilotinib versus dasatinib was \$298,836/life-year gained. Sensitivity analyses demonstrated that nilotinib and dasatinib were equivalent when nilotinib cost was below \$7,060 per month. The Monte Carlo multi-way sensitivity analysis varied all inputs by 20%. After 1000 iterations of the model, the multi-way sensitivity analysis demonstrated a high level of variability in the incremental cost-effectiveness ratio for nilotinib versus dasatinib. The cost of adverse effects associated with dasatinib and nilotinib did not significantly impact the economic evaluation.

Conclusion: Our results showed that ponatinib had higher costs and worse outcomes compared with nilotinib. Dasatinib was much less costly than ponatinib, but ponatinib had better outcomes. The decision regarding the value of the incremental gains for the incremental costs of nilotinib compared with dasatinib depends on a variety of considerations that must be taken into account beyond an economic evaluation. Our results have the potential to help third party payers assessments of these medications.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Multicenter study of environmental contamination with antineoplastic drugs in 36 Canadian hospitals

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Purpose: The 2004 National Institute for Occupational Safety and Health alert on hazardous drugs prompted many healthcare organizations to review their guidelines, policies and procedures for the safe use of hazardous drugs. Many healthcare workers are exposed to these hazardous drugs throughout the drug-use process, such as pharmacy technicians and nurses. Yet, no safe occupational exposure limit exists for many antineoplastic drugs such as cyclophosphamide, ifosfamide and methotrexate. The main objective of this study was to describe current environmental contamination with cyclophosphamide, ifosfamide and methotrexate in pharmacy and patient care areas of hospitals from Quebec, Canada.

Methods: This is a descriptive and comparative study. Twelve standardized sites were sampled in each participating center. Six sampling sites were in pharmacy areas: shipment reception counter, storage shelf, front grille inside the hood, floor in front of the hood, service hatch or post-preparation validation counter and drug delivery tray. Six sampling sites were in patient care areas: storage shelf, priming counter, arm rest, patient room counter, outpatient clinic counter, surface of drug container. Samples were analyzed for the presence of cyclophosphamide, ifosfamide and methotrexate by ultra-performance liquid chromatography tandem mass spectrometry technology. The limit of detection (LOD), in nanogram per square centimeter, was 0.0018 for cyclophosphamide, 0.0022 for ifosfamide and 0.008 for methotrexate. A sample was considered positive if the value was above the LOD. Descriptive statistical analyses (median, 75th percentile, maximum) were carried out.

Results: In 2013, 36 hospitals from Quebec, Canada, participated in this study. A total of 432 samples were quantified. Ten samples that were not standardized were excluded from the analysis. There were one to twelve out of twelve positive sampling sites per hospital. Overall, 47 percent (199/422) of the samples were positive for cyclophosphamide, 18 percent (75/422) of the samples were positive for ifosfamide and 3 percent (11/422) of the samples were positive for methotrexate. The sampling sites that were the more frequently contaminated in pharmacy areas were the front grille inside the hood (78 percent of cyclophosphamide positive samples, 28/36 samples), the floor in front of the hood (67 percent of cyclophosphamide positive samples, 24/36 samples) and the reception counter (39 percent of cyclophosphamide positive samples, 14/36

samples). The sampling sites that were the more frequently contaminated in patient care areas were the arm rest (85 percent of cyclophosphamide positive samples, 29/34) and outpatient clinic counter (51 percent of cyclophosphamide positive samples, 18/35 samples). The 75th percentile value of cyclophosphamide surface concentration was of 0.0084 nanogram per square centimeter. The 75th percentiles for ifosfamide and methotrexate concentrations were lower than the LOD.

Conclusion: The sites that were the more frequently contaminated were the front grille of the hood, the floor in front of the hood, reception counters, arm rests and outpatient clinic counters. Surface concentration of hazardous drugs should be kept as low as reasonably achievable. The use of local 75th percentile concentration is valuable to assess local contamination and to guide corrective measures. Two other multicenter studies were conducted in 2008-2010 and in 2012 in Quebec, Canada with, respectively, 25 and 33 hospitals. Surface contamination by antineoplastic drugs is decreasing over the years.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost-effectiveness of aclidinium compared with tiotropium from the chronic obstructive pulmonary disease (COPD) patient perspective

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Purpose: COPD is a progressive disease affecting the lungs and airways. The only long-acting anticholinergic (LAAC) bronchodilator prior to 2012, when the FDA approved aclidinium, was tiotropium. Currently, no cost-effectiveness studies exist comparing the two long-acting anticholinergic options from the patient perspective. The objective of this economic evaluation is to assess the costeffectiveness of aclidinium vs. tiotropium in GOLD II, III, & IV COPD patients from a patient perspective.

Methods: A cost-utility analysis was performed using a patient perspective to evaluate a >65 year-old Medicare patient population. A Markov model decision tree was utilized to compare aclidinium and tiotropium in order to measure cost per quality-adjusted life year (QALY) gained for each treatment method. Sensitivity analyses were conducted for variables with uncertainty, including mortality and exacerbations in the aclidinium arm and the costs of the two drugs based on the Medicare Part D plan costs to the patient.

Results: Aclidinium yielded \$65,121 and 13.42 QALYs over the treatment period and tiotropium yielded \$37,730 and 13.20 QALYs, leading to a final incremental cost-effectiveness ratio (ICER) of \$125,428/QALY for aclidinium vs. tiotropium in the base case analysis. One-way sensitivity analyses suggested that annual drug costs were important factors in the ICERs. Two-way sensitivity analyses related to annual drug costs suggested that as aclidinium cost falls below \$1,600, it is preferred to tiotropium at any cost. Costs above \$2,400 favor tiotropium therapy. For higher threshold willingness-to-pay (WTP) of \$110, 840 (based on WTP for dialysis in the US), aclidinium becomes preferred at a much higher cost (<\$2,400). As all-cause mortality is increased in aclidinium above 2%, tiotropium dominates. A lower exacerbation rate (27%) for aclidinium from the base case yields an ICER of \$111,377/QALY. A Monte Carlo analysis showed that 11.6% of ICERs are below a WTP of \$110,840.

Conclusion: Based on the cost-utility analysis, aclidinium was found to be slightly more effective at a much larger incremental cost when compared to tiotropium. Large variability in patient costs based on the various Medicare Part D plan costs resulted in a wide range of ICERs.

The findings suggest that step-up therapy, efficacy, and cost should be discussed so health plans and patients can make choices that are appropriate for them.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Clinical and economic burden of recurrent venous thromboembolism: an inpatient perspective

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Purpose: Venous thromboembolism (VTE), a condition including pulmonary embolism (PE) and deep vein thrombosis (DVT), represents a significant clinical and economic burden, with estimates of over 275,000 new cases each year in the U.S., and an estimated \$1.5 billion in annual healthcare expenditures. The literature reports recurrent thromboembolic events in up to 14% of patients within 1 year of an initial VTE diagnosis. Formation of subsequent VTE often results in hospital readmissions or emergency department visits; therefore, we set out to compare inpatient healthcare resource utilization between patients with and without VTE recurrences from the hospital perspective.

Methods: Patient-level hospital data derived from Premier's Perspective Database from January, 2009 through December 31, 2011 was utilized to conduct a retrospective cohort analysis of patients with VTE treated in the hospital emergency department or inpatient setting. Recurrent VTE events were defined based on a previously published algorithm requiring hospitalization at least one day from index (first VTE) event discharge date or ER visits ≥ 8 days from index, as well as a specific set of ICD-9 codes and presence of disease at admission. The study population was stratified into two comparison cohorts based on the presence or absence of recurrent VTE events within 12 months. Resource utilization (all-cause admissions, length of stay, and ER visits) and associated hospital costs in the 12 months post-index event were compared between group A (no VTE recurrence) and B (VTE recurrence) using non-parametric and Students T-tests. Hospital length-of-stay and cost were compared between the index and recurrent VTE encounter for cohort (B). The costs and utilization between the index and first recurrent encounters within patients with recurrent VTE were compared using Generalized Estimating Equations controlling for patient demographics, type of diagnosis, comorbidities, and heparin-to-warfarin bridging in the index encounter.

Results: Of the 43,734 patients who met the inclusion criteria, 1643 (4%) had recurrent VTE within 12 months of index event, of which 41% were recurrences within 30 days. Median time to recurrence was 48 days. During the 12 months after index event, patients with recurrence had significantly greater all-cause hospitalizations [unadjusted mean (SD): 1.07 (0.96) vs. 0.15

(0.53), $p<0.0001$] and emergency room visits [unadjusted mean: 0.31 (0.66) vs. 0.05 (0.31), $p<0.0001$], than patients without recurrence. Total all-cause costs to hospital were higher in patients with recurrent events compared to those without [unadjusted mean (SD): \$28,353 (\$39,624) vs. \$17,712 (\$33,461), $p<0.0001$]. Within Cohort B, GEE model showed that recurrent VTE was 22% more costly as compared to the initial event ($p<0.001$). Length of stay for recurrent VTE admissions were significantly longer (14%, $P=0.0002$) compared to index admissions.

Conclusion: Recurrent VTE events were associated with significantly greater cost from the hospital perspective, and longer LOS compared to the index event. VTE recurrences resulting in hospitalization within 30 days may place a non-reimbursable cost burden on U.S. hospitals.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Motivating factors that influenced Lebanese pharmacy students to choose pharmacy as a major

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Purpose: The Lebanese ratio of pharmacists to the general population is about 3:2000, exceeding by far the World Health Organization recommendation of 1:2000. The head of the order of pharmacists expressed a concern over the increasing number of pharmacy graduates, warning that the market would be unable to employ all the new graduates. The reason pharmacy students are interested in becoming a pharmacist and their expectations are not clear nor investigated. We conducted this study to identify motivational factors that influenced students choice of pharmacy as a major and their career preferences.

Methods: We conducted a cross-sectional descriptive study. Pre-pharmacy and pharmacy students, from the first professional to the fourth professional year, at one private and one public university were asked to participate in this study. A data collection sheet consisting of eleven multiple choice questions was designed to assess the motivational factors, including who or what influenced and encouraged the students decision to pursue a pharmacy degree. We also evaluated, the students preferred area of work upon graduation and the factors that might influence their choice to work in a community pharmacy, hospital pharmacy, as a medical representative or as a clinical pharmacist. We investigated the reasons the students might pursue a career that is not related to their pharmacy major and what would they decide to do upon their graduation. In addition, students rated their perceived knowledge of pharmacy careers and their willingness to work in governmental health facilities. The students were asked to fill the questionnaire at the end of the course session and required an average of eight minutes to be filled. Responses were anonymous; the questionnaires were collected and numbered for data analysis.

Results: A total number of 765 students participated in the study (81.2% from a private university and 18.8% from a public university). The majority of pharmacy students are female (76.5%). 24.6% of the students pursued a pharmacy degree because of their own interest in health and 18.9% because of the many career opportunities that this major can provide. Approximately 33.9% of the students were encouraged by a family member. Clinical pharmacy was the preferred career setting for public university students (38.1% compared to 13.53%, $p < 0.001$), while community pharmacy was the first choice for private university students (26.2% compared to 14.9% $p < 0.001$). The opportunity for learning was the main criteria that influence

the students career choice of community, hospital or clinical pharmacy; whereas salary was the most influencing factor in choosing medical representative as a career. 25% of the students would undertake non-pharmacy related career to fulfill their own interest and only 9.6% because of the limited job opportunities. 34.4% of the student rated a good knowledge in pharmacy careers that was comparable between private and public universities (33.8% and 36.17% respectively, $p > 0.05$). Comparable results were also obtained for working in governmental health facilities, (42.5% and 56.7%, $p > 0.05$). The majority of students would pursue postgraduate studies upon graduation.

Conclusion: Motivational and encouragement factors for pursuing a degree in pharmacy were similar in both universities. Public university students were mostly interested in clinical pharmacy practice upon graduation, while private university students were interested in community pharmacy. External factors that influence the students in selecting a career destination were opportunities for learning and salary. Students appear to lack knowledge regarding the limited job opportunities on the Lebanese market, therefore colleges and schools of pharmacy have a great interest in selecting and limiting applicants.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Economic impact of body habitus in renal transplant recipients: a single center study

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Purpose: Questions remain regarding obesity and economic outcomes in renal replacement therapies. Elevated BMI may be associated with worse outcomes and greater healthcare costs. Given the great demand of healthcare resource utilization of this population and widening gap between transplant candidates and donors, it is imperative to identify factors for more appropriate organ allocation, such as BMI, and determine if costs difference exist according to BMI at the time of transplant. The primary objective of the study was to determine the direct medical costs incurred after transplant as it relates to BMI.

Methods: This study was a retrospective cohort analysis of privately insured adults who received a primary renal transplant between 2005-2011 at The University of Cincinnati Medical Center (UCMC). The primary outcome was the cost of transplant and total annual costs thereafter per BMI category. BMI categories were classified as follows: normal=18.5-25 kg/m², overweight=25-30 kg/m², obese=30-35 kg/m², and morbidly obese≥35 kg/m². Claims data was collected from the UCMC accounting system, and descriptive and clinical information was obtained from the United Network of Organ Sharing (UNOS), EPIC, and Organ Transplant Tracking Record (OTTR) databases. All costs were standardized to 2013 dollars using the consumer price index (CPI) in order to account for inflation. A total of 374 patients received a kidney transplant from 2005-2011 at UCMC. Of these patients 45 were excluded for having a previous organ transplant prior to 2005, and 17 patients were excluded for undergoing a multi-organ transplant during the study period. An additional 54 patients were excluded due to the lack of claims data in the accounting database. Statistical analysis included nonparametric Kruskal-Wallis method of one way analysis of variance by ranks and Chi-square analysis.

Results: A total of 255 patients were included in the study (normal BMI=74 patients, overweight=85 patients, obese=64 patients, and morbidly obese=32 patients). The primary etiology of renal failure was similar among all 4 groups, the most common including diabetes mellitus, hypertension, polycystic kidney disease, focal segmental glomerulosclerosis, and IGA nephropathy. A total of 96 patients received a kidney from a deceased donor while 159 patients received a kidney from a living donor. For the average total cost of transplant there was a trend of linear increase among living donor recipients with a cost of \$82,198 for patients with a normal BMI to \$102,297 for morbidly obese patients. However there was no trend between average total

cost of transplant and BMI for deceased donor recipients. The average length of stay at time of transplant was longest for the normal BMI category (normal= 6.8 days, overweight=6.1 days, obese=5.27 days, and morbidly obese=5.81; $p=NS$). There were no significant correlations found between cost and BMI during the first three years of follow-up. Patients with a normal BMI were readmitted to the hospital 10-13% more often during the first year than patients in the other BMI categories and on average had a longer length of stay.

Conclusion: A patients BMI did not significantly contribute to the average cost of transplant regardless of the donor type. There was no statistically significant correlation between cost and BMI during annual follow up time points. This study was limited by the number of patients included due to the fact that it was a single center study. Future studies need to be conducted with a larger patient population.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost effectiveness analysis of alendronate versus denosumab for the treatment of osteoporosis in postmenopausal women, a healthcare payer perspective

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Purpose: Currently, alendronate is the most widely utilized agent in the treatment of osteoporosis. Alendronate is an oral tablet that is taken once weekly. Denosumab, an alternative therapy for the treatment of osteoporosis, is a twice yearly injection. Although the cost of denosumab is higher than that of alendronate, denosumab has also been shown to be more efficacious. To determine the cost effectiveness of alendronate versus denosumab, an analysis of cost per fracture averted was conducted.

Methods: The population of this cost effectiveness analysis included postmenopausal women, ages 55 to 90 years old, who have been diagnosed with osteoporosis and who had a T-score of -2.5 to -4.0. A decision tree was utilized to determine the incremental cost effectiveness ratio of the implementation of denosumab, branded alendronate, and generic alendronate over the course of 3 years. Cost was measured in US dollars and effectiveness was measured in number of fractures averted. This analysis evaluated total cost of fractures, cost of drug, adherence rate, and fracture rate. The data used in this study was extracted from trials that researched efficacy and adherence. In addition to a cost effective analysis, two one-way sensitivity analyses were conducted, studying both the uncertainty of adherence rates and cost of denosumab.

Results: Denosumab and generic alendronate were comparable, but branded alendronate was dominated. The ICER of denosumab therapy was \$3,031 per fracture averted compared to generic alendronate, which means that it costs \$3,031 more for an additional fracture averted with denosumab treatment than with generic alendronate treatment. According to the one-way sensitivity analysis conducted on the uncertainty of adherence, even if the adherence rate to alendronate was high (0.6 compared to 0.4), denosumab would still be a cost effective option with an ICER of \$5,797 per fracture averted because the ICER is less than the cost of a fracture. In the other one-way sensitivity analysis that investigates cost variation of denosumab, it was determined that at a price of \$923 per injection, compared to the current price of \$990, denosumab therapy would equal the cost of alendronate therapy while still providing one more fracture averted.

Conclusion: Denosumab is a cost effective therapy in preventing a fracture compared to branded and generic alendronate since it costs less to pay for a fracture averted while on denosumab therapy than to pay for treating a fracture.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost-effectiveness analysis of aflibercept and bevacizumab from a third party payer perspective in the treatment of neovascular age-related macular degeneration

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Purpose: Neovascular age-related macular degeneration (AMD) is the most common cause of severe vision loss in older Americans. Overexpression of vascular endothelial growth factor (VEGF) plays a significant role in disease progression, and is the primary target for pharmacological treatment. Bevacizumab, a VEGF inhibitor approved for cancer treatment, is repackaged into small doses and is widely used off label for intravitreal injection. While it is significantly cheaper than other VEGF inhibitors approved for neovascular AMD, serious adverse events such as endophthalmitis are more prevalent. The most recently approved VEGF inhibitor for neovascular AMD, aflibercept, offers the advantage of intravitreal injections half as frequently, in addition to a more favorable side effect profile. The objective of the cost-effectiveness model was to compare the cost per year of maintained vision using bevacizumab versus aflibercept in patients with neovascular AMD, aged 75 years and older in the United States.

Methods: A Markov model to assess the cost of maintained vision from a third party payer perspective was developed. Efficacy was taken from clinical trial data, as was incidence of serious adverse events and mortality for each treatment arm. Costs included those required for each drug, for physician office visits, and for treatment of serious adverse drug reactions requiring hospitalization. One year cycles ran for twenty-five years, until patients experienced a decline in vision, or until they died. Costs and outcomes were discounted at a rate of 3 percent per year. Sensitivity analyses were run on all inputs to test the models robustness.

Results: The cost associated with bevacizumab therapy was \$92,994 and the effectiveness was 5.67. The cost associated with aflibercept therapy was \$138,472 and the effectiveness was 6.31. The incremental cost effectiveness ratio was \$70,486. A one-way sensitivity analysis evaluating change in cost per treatment of bevacizumab indicated that bevacizumab remained cost-effective until cost was increased to \$8,980. Increases in yearly costs of bevacizumab were analyzed to account for the increased frequency of injection, and bevacizumab remained cost effective until the threshold of \$21,440 per year was reached. Adjusting the probability of getting an ADR did not meaningfully affect bevacizumabs cost effectiveness nor did adjusting for efficacy. When cost per ADR in the bevacizumab group reached \$92,240, aflibercept was more cost effective.

Conclusion: Despite most circumstantial variations, bevacizumab is more cost effective than aflibercept in the treatment of neovascular AMD. Depending on how often bevacizumab is administered per year, and whether new ADR data becomes available, this treatment strategy may be examined more thoroughly in the near future. Clinical trial data are necessary to ascertain the appropriateness of bevacizumabs cost effectiveness. Should they become available, quality of life inputs could be incorporated into future analyses in order to provide guidance to decision-makers.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Ethical and economic implications of rationing intensive treatment based on gestational age in extremely preterm births

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Purpose: Neonatal intensive care in extremely preterm infants is associated with high costs and rates of disability. Determining the limit of viability of extremely preterm infants is a controversial issue that must take into account multiple factors. This study performs an economic evaluation from a third party perspective to explore the effects of setting a minimal gestational age cut off for use of intensive intervention.

Methods: A simple decision analytic model was used to determine costs and lives saved of infants born at 24 weeks gestation and 26 weeks gestation. Cost and probability data were extracted from published sources. The intervention was to develop a cut-off age for the use of intensive treatments at a minimal age of 26 weeks gestational age. This was compared to current practice in which intensive treatments are generally recommended in premature infants born at as low as 24 weeks gestation. The major outcomes in this study were survival to 7 years and the associated costs of saving a life. Incremental cost-effectiveness ratios (ICERs) were calculated to compare the cost-effectiveness of each cut-off age. A scenario analysis was performed to assess the effects of best and worst case scenarios on costs per life saved. In addition to the moral claims of stakeholders involved and relevant legal facets, principles of utility, distributive justice, and autonomy were investigated to determine the ethical ramifications of establishing a minimum gestational age for intensive treatment.

Results: When compared with the 24 week minimal gestational age cut-off, the 26 week gestational age cut off was less expensive, but yielded fewer lives saved. Using a gestational age cut-off at 24 weeks would cost \$461,336 more to save one life when compared to a 26 week gestational age cut-off. The scenario analysis determined the best case would cost \$301,465 more when applying the minimum cost of survival. The worst case would cost \$485,471 more when applying the minimum probability of survival.

Conclusion: It costs more to save one life with a minimal gestational cut-off at 24 weeks compared to 26 weeks. However, it is not recommended to base treatment plans on costs alone due to ethical implications associated with determining the viability of preterm infants. It is impossible to put a value on life or to determine the chance of survival and disability, solely

based on gestational age. Ultimately, treatment plans for extremely preterm infants should be based on the best interest of the patient and should be made on a patient specific basis through mutual agreement of the parents and physicians.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Pneumonia readmission predictors: Does one size fit all?

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Purpose: On October 2012 the Hospital Readmission Reduction Program, part of the Affordable Care Act, was officially set into place. The program provides incentive for hospitals to meet or exceed a predicted 30-day readmission ratio in Medicare patients readmitted for heart attack, heart failure, and pneumonia. The purpose of this project is to establish a baseline for all cause and same cause 30-day readmission rate for pneumonia patients, identify predictors of pneumonia readmission, and find interventions that may be made by our antibiotic stewardship program to reduce preventable readmission.

Methods: A retrospective chart review was performed for patients discharged between April 2011 and March 2013 with a diagnosis of pneumonia (APR-DRG 193,194, and 195) that were readmitted within 30 days for all cause or same cause APR-diagnosis related group (DRG). Crimson Continuum of Care platform release CCC.2013.01 was utilized in order to obtain the name and account number for patients meeting criteria. Data collected included baseline demographics, severity level, index admission length of stay, numbers of days to readmission, comorbid conditions, instability factors (temperature >99F, respiratory rate >24, heart rate >100 beats per min, systolic blood pressure <90mm Hg, oxygen saturation <90%, altered mental status), labs at discharge, reason for readmission, number of medications at discharge, SIRS criteria, or if the patients received hemodialysis, chemotherapy, or blood product transfusion during their index stay. The severity level used in this study was provided by Crimson and is determined by principal diagnosis, principle procedure, age, sex, discharge status, as well as the secondary diagnoses. We included all Medicare patients and excluded patients who upon discharge from the index admission went to hospice, or if the index admission was less than one day.

Results: There were a total of 33 patients after exclusion criteria. Our 30 day readmission rate for all cause DRG was 11.5% and same cause rate was 1.7%. Within 6 days of discharge 42% of patients were readmitted. Predictors of readmission included the following: discharge hemoglobin <12, albumin <3.5, BUN >21, serum creatinine >1.2, and hyponatremia. Hypertension, congestive heart failure, chronic obstructive pulmonary disease, anemia and osteoarthritis were the most prevalent comorbidities. Patients were more likely to be readmitted if they were discharged on 6 or more medications, if the patient was discharged home, or had a severity index of 3 or more. There was no association found between commonly accepted instability factors and our study patients.

Conclusion: Pneumonia readmission rates for our institution were better than reported averages available through <http://www.medicare.gov/hospitalcompare> or the Crimson platform. By evaluating inpatient antibiotic therapy for appropriateness our antibiotic stewardship program may be able to reduce same cause readmissions. Opportunities to decrease all cause readmissions may be made by utilizing home health care, evaluating the patients nutritional status, and addressing underlying comorbid conditions at discharge.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Pharmacist-led medication reconciliation in orthopedic surgery patients: effect on HCAHPS scores and medication errors

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Purpose: Medication reconciliation is an opportunity for pharmacists to improve patient care and patient experience. Recent publications have demonstrated that pharmacists provide more thorough medication histories than other healthcare providers. To improve the medication communication domain of the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey, pharmacist-led medication reconciliation was initiated with patients admitted to the orthopedic service at a community teaching hospital. The purpose of this study is to evaluate the effectiveness of this program on the medication domain of the HCAHPS survey and to quantify pharmacist detection of medication errors.

Methods: Medication reconciliation was completed by a pharmacist during the perioperative period or at an elective pre-operative class. Along with updating the electronic medication record, the pharmacist also recorded the number and types of errors detected during medication reconciliation. Patients excluded from medication reconciliation, but not from data analysis, were those whom did not have a pharmacist available during their admission, were unavailable at the time of pharmacist visit, had poor cognition, were unable to provide medication history, were in isolation precautions, had psychiatric consults or refused medication reconciliation. A retrospective chart review was conducted from November 1, 2012 through March 31, 2013 to determine if medication reconciliation was completed by a pharmacist. The primary outcome of this study was to compare the always response to the overall medication communication domain, as well as the responses to the two individual questions comprising this domain during the study period to the 5 month baseline period.

Results: A pharmacist completed medication reconciliation for 56 of the 154 patients during the study period. A total of 170 medication errors were detected, averaging approximately 3 errors per patient. The types of medications errors detected included incorrect drug, dose or frequency, omissions, duplications, active medications discontinued by the patient and transcription errors. The percent always responses for overall medication communication, new medication indication, and new medication side effects during the baseline period were 55.8%, 69.8%, and 41.7%, respectively. These responses correlated to the 10th, 13th, and 10th percentiles. During the study period the percent always responses increased to 60% ($p = 0.73$), 75% ($p = 0.83$), and 44% ($p =$

0.65), respectively. These responses correlated to an increase in the percentile rankings to the 33rd, 45th, and 25th percentiles.

Conclusion: Pharmacist-led medication reconciliation demonstrated an absolute increase in the patient experience scores. While there were absolute increases in the response always, the difference was not large enough to show statistical significance due to the small sample size. The absolute increase in HCAHPS scores, along with the reduction in medication errors emphasizes the value of pharmacist-led medication reconciliation.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Drug usage patterns in cardiac catheterization procedures and the affect of drug regimen selection on drug cost per procedure

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Purpose: Cardiac catheterization procedures generally include the use of various costly medications. Institutions often estimate the projected cost and make formulary decisions based on dosing regimens from published guidelines. However, in actual practice, clinicians often vary from these standard dosing regimens. The purpose of this study was to retrospectively measure the use of IIb/IIIa inhibitors and bivalirudin in cardiac catheterization, and compare the total drug cost of therapy per intervention based on the actual dosing regimens utilized. The drug regimen selections of cardiologists were also compared.

Methods: The institutional review board approved this retrospective study. Hospital billing records for all cardiac catheterization procedures conducted from March 2011 through March 2012 were collected. Dosing regimens were separated into five different categories, monotherapy with eptifibatide, abciximab, or bivalirudin, eptifibatide plus bivalirudin, and abciximab plus bivalirudin. The number of vials of each product used per case was recorded and multiplied by cost per vial to calculate cost per case for each dosing regimen.

Results: A total of 1020 cardiac catheterization procedures were included in the study. The most common dosing regimens used were bivalirudin monotherapy at 62%, eptifibatide monotherapy at 19%, eptifibatide plus bivalirudin at 10%, abciximab monotherapy at 6%, and abciximab plus bivalirudin at 3%. Drug cost per case was \$2354 for eptifibatide plus bivalirudin, \$2248 for abciximab plus bivalirudin, \$1475 for eptifibatide monotherapy, \$1078 for abciximab monotherapy, and \$961 for bivalirudin monotherapy. Monotherapy with bivalirudin or abciximab was significantly more cost effective than other regimens, while regimens combining a IIb/IIIa inhibitor with bivalirudin were significantly more expensive ($p < 0.05$). Three cardiologists accounted for over half of all combination therapy cases (IIb/IIIa plus bivalirudin). These three cardiologists utilized combination therapy in 68%, 26%, and 19% of cases they performed respectively, whereas combination therapy was chosen in only 9% of all physician cases.

Conclusion: Cost per case varies significantly based on the dosing regimens utilized in cardiac catheterization procedures. Combination therapy regimens were used more frequently based on the physician performing the case. Significant cost saving opportunities may exist by affecting physician product selection.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Evaluation of the immunoglobulin use in inflammatory systemic and immunomediated illnesses in a tertiary hospital

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Purpose: To assess the indications for what intravenous immunoglobulin (IvIg) treatment was prescribed in patients with inflammatory systemic and immunomediated illnesses, older than 18 years. The assessment also intends to ensure if the clinical indications matched with the evidence-based clinical guidelines recommendations of use.

Methods: Analytical, observational, transversal and retrospective study carried out during 2012. Patients older than 18 years old were included, and the data collected were: age, sex, total number of administrations, dosage, frequency, commercial brand and the indication for what the IvIg treatment has been prescribed. As a reference guide the British Health Department Clinical Guidelines for Immunoglobulin Use (2nd Edition, 2008, and 2nd Edition Update 2011) and its Spanish adaption were used. According to these guidelines, indications were standardized so it could be possible to compare them with the indications classified in the guidelines. This classification consists on: - If the indication is recommended or not, for short-term or long-term treatment or if the recommendation depends on the patients circumstances, - Depending on the grade of strength of recommendation or evidence (A-C, I-III), - Depending on the treatments priority: o Red: maximum priority, severe illness without therapeutic alternative. o Blue: although there is evidence of its efficacy, there are other therapeutic alternatives. o Grey: because of the low incidence of these pathologies, there are few studies to assess the efficacy of the treatment. o Black: its use is not recommended.

Results: 68 patients with systemic inflammatory and immunomediated illnesses were evaluated. The most frequent indications were: dermatomyositis (16.18%), systemic lupus erythematosus (13.24%), inflammatory myopathies (10.29%), immune thrombocytopenic purpura (5.88%), and those related to kidney, liver or lung transplantation (27.94%). Among the indications related to transplantation, 89.47% were due to antibody mediated rejection and 10.53% were due to antibody incompatible transplant. It is also worth commenting that among the inflammatory myopathies, there were three that were related to statin myotoxicity. Other less frequent indications were Parvovirus B19 infection (1.47%), Susacs syndrome (1.47%), systemic vasculitis (1.47%), acquired hemophilia (1.47%) or Von Willebrand syndrome (1.47%). Up to 45.59% of the indications had a grade of recommendation A, B or C, with an acceptable grade of

evidence. Grey indications were 50%, which means weak evidence. When referring to these grey indications, it has to be taken into account that the weak evidence is due to the low incidence. Finally, it was only found one black indication (1.47%) which corresponded to a severe rheumatoid arthritis, for whose treatment is not recommended the immunoglobulin use.

Conclusion: The IvIg treatment was justified by a grade of recommendation A, B or C in 45.59% of the indications. Thus in 50.47% (grey and black indications) the IvIg use would be, at least, questionable because of its weak or inexistent evidence. It is important to highlight the importance of consensus guidelines for IvIg use to guide doctors and pharmacists in their clinical practice, especially in the internal medicine area which includes a large number of complex pathologies. Moreover, it is important to prioritize which indications and circumstances are of first importance to have their supply guaranteed.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Evaluation of the immunoglobulin use in patients with immunoneurological disorders in a tertiary hospital

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Purpose: To assess the indications for what intravenous immunoglobulin (IvIg) treatment was prescribed in patients with immunoneurological disorders, older than 18 years old. The assessment also intends to ensure if the clinical indications matched with the evidence-based clinical guidelines recommendations of use.

Methods: Analytical, observational, transversal and retrospective study carried out during 2012. Patients older than 18 years old were included, and the data collected was: age, genre, clinical history number, total number of administrations, dosage, frequency, commercial brand and the indication for what the immunoglobulin treatment has been prescribed. As reference guides were used the British Health Department Clinical Guidelines for Immunoglobulin Use (2nd Edition, 2008, and 2nd Edition Update 2011), and its Spanish adaption. According to these guidelines, indications were standardized so it could be possible to compare them with the indications classified in the guidelines. This classification consists on: - If the indication is recommended or not, for short-term or long-term treatment or if the recommendation depends on the patients circumstances, - Depending on the grade of strength of recommendation or evidence (A-C, I-III), - Depending on the treatments priority: o Red: maximum priority, severe illness without therapeutic alternative. o Blue: although there is evidence of its efficacy, there are other therapeutic alternatives. o Grey: because of the low incidence of these pathologies, there are little studies to assess the efficacy of the treatment. o Black: its use is not recommended.

Results: 67 patients with immunoneurological disorders were analyzed. The most frequent indications were: myasthenia gravis exacerbations (20.90%), chronic inflammatory demyelinating polyradiculoneuropathy (17.91%), multifocal motor neuropathy (10.45%), peripheral polyneuropathy (7.46%), Guillain-Barr syndrome (5.97%) and inflammatory myopathies (4.48%). Other less frequent indications were Eaton-Lambert syndrome (2.99%), Stiff person syndrome (2.99%) or drug-resistant epilepsy (1.49%). 67.16% of the indications had a grade of recommendation A, B or C, with an acceptable grade of evidence. 23.88% of the indications were grey, which means weak evidence. When referring to these grey indications, it has to be taken into account that the weak evidence is due to the low incidence. Finally, 4.48% of the indications corresponded to the black ones, which are not recommended. Among these we

found one patient with multiple sclerosis (1.49%), one amyotrophic lateral sclerosis (1.49%) and a critical illness neuropathy (1.49%).

Conclusion: The immunoglobulin treatment was justified by a grade of recommendation A, B or C in 67.16% of the neurological indications. Thus, in a 28.36% (grey and black indications) the immunoglobulin use would be, at least, questionable because of its weak or inexistent evidence. It is important to highlight the importance of consensus guidelines for immunoglobulin use to guide doctors and pharmacists in their clinical practice, especially in the immunoneurological field where the pathologies are of a great complexity. Moreover, it is important to prioritize which indications and circumstances are of first importance to have their supply guaranteed.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Long term stability of acyclovir infusion: the brand name versus a generic product.

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Purpose: To investigate the stability of acyclovir versus one of his generic compound. in NaCl 0,9% stored at 4C during 15 days.

Methods: Five bags of acyclovir brand name 500mg/100mL and five bags of the same concentration of generic compound were prepared under aseptic conditions and stored 15 days at 4C. An High-pressure liquid chromatography using a reversed-phase column C18 and a mobile phase consisting of 97% ammonium formate 20mM at pH 3,5 with HCl and 3% acetonitrile was used and coupled to a photodiode array with a wavelength set at 260nm. Optic density measurement at different wavelengths, pH measurement and optic microscope observation were performed periodically during the storage. A forced degradation test with HCl 12M and NaOH 5M with and without heating at 100C was also performed. Stability of the solutions was defined as the one sided 95% confidence interval of the common regression line remains superior to 90% of the initial concentration as recommended by the FDA

Results: The only one forced degradation test that yielded chromatograms with degradation products peak was the test with the acid solution heated at 100C. No significant change in pH values or optic density was seen during the study. No crystals were seen with the optic microscope during the study. After 15 days, the loss was lower than 10% according the FDA predefined definition

Conclusion: Within these limits, the two acyclovir infusions were stable during the 15 days-study period when stored at 4C.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost Effectiveness Analysis of Probiotics Adjunct Therapy in Reducing the Incidence and Duration of Clostridium difficile-Associated Diarrhea in Hospitalized Older Adults

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Purpose: Clostridium difficile-associated diarrhea (CDAD) is a severe form of antibiotic-associated diarrhea. The incidence of CDAD has increased sharply in the past decade, infecting approximately 500,000 individuals annually and posing a large economic burden on the healthcare system. A randomized controlled trial by Gao et al. (2010) shows evidence that prophylactic probiotic therapy is associated with lower incidence and shorter duration of CDAD. Based on efficacy data of the Gao study, the purpose of this analysis is to determine the cost-effectiveness of probiotic adjunct therapy to reduce the incidence and duration of CDAD in hospitalized older adult patients on antibiotics.

Methods: A cost-effectiveness analysis was conducted from the third party payers perspective. The analysis included patients ages 50-70, hospitalized for 5 or more days, and who were initiated on antibiotics during their stay. Probiotic therapy was started within 36 hours of the initiation of antibiotics in-house, and continued for 5 days post discontinuation of antibiotics. Patients were also monitored 21 days post-probiotic discontinuation. Three treatment options were compared: probiotics 2 capsules or 100 billion colony-forming units (cfu)/day, probiotics 1 capsule or 50 billion cfu/day, and placebo (usual care only). Efficacy and cost data were extracted from published literature for the base case and sensitivity analysis. Cost effectiveness was evaluated as the incremental cost to treat and prevent CDAD relative to the days saved from CDAD. One-way sensitivity analyses were performed for all efficacy inputs (incidence, duration, and CDAD days saved) and all cost inputs. Variables with the largest effects on outcomes were tested in two-way sensitivity analyses.

Results: Efficacy data showed that probiotics are superior to placebo in preventing and reducing the severity of CDAD (6.37 and 6.01 days of CDAD illness saved compared to 4.88 days saved with placebo), and that the higher dose of probiotics is more efficacious than the lower dose (6.37 vs. 6.01 days of CDAD illness saved). Base case results showed that probiotics were cost saving compared to placebo with regards to CDAD; the average cost incurred per patient was \$91.58 (2 capsules/day) and \$336.01 (1 capsule/day) for probiotic treatment groups and \$784.92 per patient for the placebo group (usual care only). Because low-dose probiotic treatment was more effective and less costly than placebo, low-dose probiotic treatment dominated the placebo

option. The higher dose of probiotic was also more effective and less costly than the lower dose of probiotic, rendering it dominant over the lower dose option as well. One-way sensitivity analyses for all efficacy data and all cost data did not affect the dominance of treatment arms despite conservative inputs. In two-way sensitivity analyses, dominance remained unchanged.

Conclusion: High-dose probiotics adjunct therapy is cost-effective as a prevention method to reduce the incidence and duration of *Clostridium difficile*-associated diarrhea. Both high-dose and low-dose probiotics adjunct therapy demonstrated economic value compared with placebo. Findings from this analysis offer additional information to health care providers and third party payers about the use of high dose probiotic therapy in hospitalized patients on antibiotics to reduce the incidence of CDAD and its economic burden.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Assessment of pharmacy students' perception and knowledge of palliative care.

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Purpose: Purpose: The Accreditation Council of Pharmacy Education (ACPE) recommends that end of life care principles and palliative care concepts be part of the pharmacy curriculum. Pharmacists involvement in palliative care through their recommendations and crucial interventions, significantly help patients achieve positive outcomes that affect their quality of life. The objective of this project is to assess and evaluate pharmacy students perception and knowledge of palliative care (PC) during their Advanced Pharmacy Practice Experiences (APPEs).

Methods: Methods: Two separate APPE clerkships with focus in PC are offered to students as a 4-week clerkship part of their 1 year APPEs. During their clerkship rotations, students round with the interdisciplinary team, learn about the principles of PC with an emphasis on the pharmacological management of pain and symptom control in the PC patient population. A survey instrument was developed and distributed to evaluate the perception of pharmacy students who completed at least one 4-week PC rotation as part of their 1 year APPEs. The survey assessed the students on the following: their attitude and perception of PC principles, their understanding of the role of the pharmacist in that setting and their knowledge of drug therapy pertaining to PC.

Results: Results: A total of 30/34 (88%) of the students completed the survey. All participants indicated that the clerkship provided them with sufficient training in pain management and PC principles and exposed them to ethical issues in this patient population. Additionally, 96.7% indicated that importance of pharmacy students to learn about PC issues. 80% and 83% of the participants felt prepared discussing PC with their families and their patients, respectively. Majority, 96.7%, of the participants agreed that pharmacists serve as a resource in education, drug information, and play an integral role in optimizing medication regimen. 83% of the participants showed competency when asked specific questions regarding medications use in PC. 80% of participants indicated that PC should be provided to patients regardless of the underlying conditions. All participants indicated that they would recommend this clerkship to future students.

Conclusion: Conclusion: This survey showed that this clerkship had a positive impact on students perception and knowledge of PC principles. As the practice of PC evolves, and the role of the pharmacist in this specific setting expands, advanced training in PC is vital.

Category: Psychotherapy / Neurology

Title: Consumer-led intervention to improve pharmacists' attitudes toward mental illness: a pilot study

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Purpose: Individuals with a mental illness often manage complex medication regimens and would benefit from support and education from their pharmacist. Pharmacists with stigma or negative attitudes toward individuals with a mental illness may be less likely to counsel and provide services to these patients. A consumer-led educational intervention significantly reduced negative attitudes of pharmacy students toward individuals with a mental illness. There is no known data on such an intervention for pharmacists. This study will determine the effects of a consumer-led Continuing Education (CE) program on pharmacists attitudes and willingness to provide services to patients with a mental illness.

Methods: Fifty pharmacists were recruited through the CE program provider at Northeastern University. The CE program began with a brief overview of the history of U.S. mental healthcare. Two consumers with a mental illness then spoke about their personal experiences including dark days, acceptance, treatment, coping skills, and successes, hopes, and dreams. This portion was coordinated by the National Alliance on Mental Illness. Pharmacists in attendance were asked to complete three surveys: the first immediately before the CE program, the second immediately after the CE program, and the third two months after the CE program. The surveys were identical and used a Likert scale to measure pharmacists social distance toward, attitudes toward, and perception of the needs of individuals with a mental illness. Pharmacists willingness to provide pharmacy services to patients with schizophrenia compared to patients with asthma was also evaluated on a Likert scale. Data was entered into SPSS 21.0 and analyzed using descriptive statistics, paired t-tests to compare pharmacists responses before the CE program to after, and linear regression models to determine factors that affect pharmacists willingness to provides services to patients with schizophrenia. IRB approval was obtained.

Results: Of the 50 pharmacists at the program, 32 completed Surveys 1 and 2. Of the 29 who provided contact information, 15 completed Survey 3. There was a significant decrease in total social distance from Survey 1 to Survey 2 ($p=0.000$). This effect was not maintained at the two month follow-up on Survey 3. The scores reflecting pharmacists empathy, beliefs, and perceptions toward individuals with a mental illness significantly improved from Survey 1 to Survey 2 ($p=0.018$ for empathy, $p=0.000$ for beliefs, $p=0.000$ for perceptions). This effect was maintained; there were no significant changes from Survey 2 to Survey 3. Pharmacists willingness to provide services to patients with schizophrenia significantly increased from Survey 1 to Survey 2 ($p=0.000$) and was maintained at Survey 3. Pharmacists reported

significantly greater willingness to provide services to patients with asthma than patients with schizophrenia on Surveys 1, 2, and 3 ($p=0.000, 0.008, 0.044$ respectively). While controlling for gender, age, and personal experience with mental illness, the linear regression models showed that empathy, positive beliefs, and positive perceptions predicted increased willingness to provide services to patients with schizophrenia at Survey 2. Total social distance did not predict willingness to provide services to patients with schizophrenia.

Conclusion: This study showed sustained improvements in pharmacists empathy, beliefs, and perceptions of and willingness to provide services to patients with a mental illness, indicating that a consumer-led intervention may be an effective way to improve the provision of pharmacy services to such patients. The sum social distance score was the only outcome that did not remain significant two months after the program. The social distance score reflects very personal beliefs, which may be more resistant to change than other outcomes that reflect more professional beliefs. Research with a larger sample and longer follow-up time would further validate these results.

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Category: Psychotherapy / Neurology

Title: Long term use of enoxaparin for thromboprophylaxis in a psychiatric patient with a mechanical heart valve

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Purpose:

Methods:

Results:

Conclusion:

Category: Small and Rural Pharmacy Practice

Title: Patient-centered care at discharge: Phase 1, bringing the pharmacy to the bedside in a small rural hospital

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Purpose: Capture of discharge prescriptions has been a strategic goal for retail pharmacies for a number of years. Secondly, patients discharged from rural hospitals face added barriers such as the hometown pharmacy being closed for the day or the medication is not something normally stocked. These barriers can lead to delay in medication administration and poor outcomes. Providing pharmacy-led discharge medication reconciliation is a desirable service to improve patient-centered care and lower re-admission rates. Phase 1 of this project was designed to improve capture of discharge prescriptions by 15% at a small 88-bed mid-western rural hospital.

Methods: The director of the retail and inpatient pharmacy requested one full time equivalent (FTE) to improve discharge medication reconciliation and capture of discharge prescriptions. The proposed medication reconciliation project assigned a certified pharmacy technician to be responsible for inpatient review and revision of home medications, allergies, and immunizations for all daily admits; and on the retail side capture, fill, provide patient education, and bedside delivery of discharge prescriptions. Quantitative data was gathered using the following formula: number of new prescriptions filled at discharge divided by total hospital discharges per month multiplied by 2.7, the average number of new prescriptions each patient has at discharge. Secondly, quality improvement data was gathered using the Plan, Do, Check, Act (PDCA) method to refine the process used to capture discharge prescriptions. A multi-disciplinary team was formed to review and refine the process. As the process was rolled-out, the team met to make changes based on the results being achieved.

Results: The goal was to capture 15% of new prescriptions revenue. Data was gathered from November 2012 to May 2013. Over the first seven months of the project, our average new prescription capture has been 13.3%, range 10.4% to 17%. The process to capture prescriptions was initially started by having the technician review hospitalist discharges after morning rounds. It was found that the timing was too late in the process, as patients were ready to be discharged, and the pharmacy had no time to properly prepare the prescriptions before the patient was ready to leave. At this point the process was changed to have the technician meet with patients upon admission to offer the service. If the patient was interested, a note was placed on the discharge checklist, so that the nurse would know to send any prescriptions to the pharmacy as soon as they were written. This allowed the pharmacy sufficient time to prepare the prescription prior to the patient actually being discharged, and allowed for better results overall.

Conclusion: The retail pharmacy goal to capture 15% of new prescriptions for our inpatient population showed promising results. To increase results, there are a number of barriers to improve: 1) Evaluation of technicians rights in the computer system to allow access to all necessary functions, 2) Education of nursing staff on the process, and 3) Patient education. Most hospitalized patients are not accustomed to meeting with a pharmacy representative. Our pharmacy-led discharge process improved awareness of the pharmacy services offered, and additional services that can be provide upon and after discharge. Within seven month, improved prescription capture rate was achieved.

Category: Small and Rural Pharmacy Practice

Title: Get it right the first time

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Purpose: Good medication reconciliation is an important part of patient care and complete, accurate medication reconciliation across the continuum of care is a major component in reducing readmission of patients to the hospital. As a rural hospital and Pioneer Accountable Care Organization (ACO) facility, improvement of the medication reconciliation process was targeted as one way to improve patient outcomes both during hospitalization and after discharge thereby reducing readmissions of those patients.

Methods: A pharmacist undertook an evidence based practice project aimed at improving the medication reconciliation process. Opportunities for improvement were identified during observations of the medication reconciliation process of planned hospital admissions, emergent hospital admissions, hospital discharges, primary care provider follow-up visits and post discharge home care visits. It was determined that nurses and pharmacists needed more education about how to do medication reconciliation properly. An online training module was developed to educate nurses and pharmacists how best to do medication reconciliation using one on one discussion with the patient and/or family member, patient's pharmacy, patient's primary care provider, specialist providers, and the home medication list section of the electronic medical record in the hospital computer system. A list of questions to be used during patient interview was developed to prompt complete medication reconciliation. In addition, hospital emergency department nurses, bed control nurses and rounding nurses for the local cardiology offices were trained with hands-on computer classes on how to enter medications, revise medication entries and delete medications on prior to admission lists as well as how to interpret the information on the lists once they were completed.

Results: Thirty-one nurses completed the hands-on computer classes and all participants indicated on the post-class evaluation that the information provided was helpful. In addition, many felt that the information would improve their ability to do medication reconciliation accurately. Members of the medical staff, pharmacists and nurses have all taken more interest in making sure that the patient's home medication list is accurate and have expressed support for the new program as everyone works together to improve patient outcomes. Pharmacists, inpatient unit nurses and members of the medical staff have noticed an improvement in accuracy of patient home medication lists as indicated by fewer dose and drug clarifications needed after admission. This facilitates computerized physician order entry (CPOE) as active medication orders are pulled directly from the home medication list into the inpatient profile.

Conclusion: Review of evidence based practice information about and evaluation of the medication reconciliation process helped to implement training that has improved the accuracy of medication reconciliation for patients on admission to and at discharge from the medical facility. This has improved accuracy of orders pulled into the inpatient profile from the home medication list via computerized physician order entry.

Category: Small and Rural Pharmacy Practice

Title: Immunization blitz to improve zoster vaccination in rural health veterans

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Purpose: Herpes zoster incidence among people 60 years of age and older is approximately 10 cases per 1,000 United States population annually. An estimated one million cases of herpes zoster occurs yearly. Zoster immunization (Zostavax) was added to the Veterans Affairs National Formulary in January 2008 to decrease the incidence and complications of herpes zoster. However, only 27 percent of eligible veterans seen in our smaller rural VA Community Based Outreach Clinics (CBOCs) had received the zoster immunization as of April 2012. The goal of this project was to increase the vaccination rate of eligible veterans by at least 10 percent.

Methods: To ensure high quality patient centered care for all rural veterans in the prevention of herpes zoster, pharmacy proposed Zostavax Blitz days to the CBOCs. Using a newly developed reminder report, patients whom had the zoster immunization reminder due were screened by pharmacy students to ensure the Veterans Affairs Pharmacy Benefit Management Services (VA PBM) Criteria for zoster immunization was met. Pharmacists reviewed the pharmacy student's assessment, but the time spent was minimal since the student did the initial review. CBOC Clinic staff called and scheduled patients to come during the Zostavax Blitz day. Five Zostavax Blitzes were scheduled in the rural CBOCs from May to September 2012. Pharmacy students and residents provided the zoster immunizations on the Zostavax Blitz day. In addition to CBOC Zostavax Blitzes, veterans with non-PACT appointments were encouraged to stop by the pharmacy to ensure they received the zoster immunization. Pharmacist counseling at the outpatient pharmacy screened veterans during their counseling session.

Results: Approximately 500 zoster immunizations were administered to rural veterans during the Zostavax Blitz Days. Veterans seen in the smaller rural CBOCs that had received the zoster immunization increased from 27 percent to 39 percent after the implementation of the Zostavax Blitzes. Veterans were very appreciative of the service the pharmacy and pharmacy students provided to their CBOCs. Veterans carpooled to the CBOCs with less than one hour drive, instead of driving over three hours one way to the main facility. Utilizing pharmacy residents and students to screen medical records, immunize veterans, and document the immunization in CPRS increased productivity of other health care team members, including providers, nurses, and pharmacists, that would normal provide these services. In addition, pharmacy students obtained valuable experience by immunizing patients.

Conclusion: By implementing Zostavax Blitzes in the CBOCs, the pharmacy department met their goal of increasing the percentage of eligible rural veterans receiving the zoster immunization by 12 percent. In order to continue to focus on preventing herpes zoster and the potential complications related to herpes zoster, the pharmacy service will continue to utilize

pharmacy students and residents to provide Zostavax blitzes to increase the number of veterans immunized with zoster immunization in our rural CBOCs.

Category: Small and Rural Pharmacy Practice

Title: Comparison of insulin requirements in patients receiving Lantus and those receiving Levemir

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Purpose: To evaluate if basal insulin requirements had changed after utilization moved primarily to Levemir.

Methods: All patients treated with basal insulin during the months of July 2012 through October 2012, when the physician chose to use either Lantus or Levemir, were compared with patients treated primarily with Levemir during the months of November 2012 through February 2013. The average age of the patients, the average weight of the patients in kilograms (kg), the number of females and males in each group, the average days of basal insulin therapy, the average increase in units of Levemir or Lantus from baseline, the average decrease in units of Levemir or Lantus from baseline, and the average early morning glucose level were used for comparison.

Results: Group One (July 2012 through October 2012) results for Levemir patients were an average age of 61, an average weight of 92.2 kg, six females and four males, an average of 4.7 days of therapy, an average overall increase of 6.1 units of Levemir, an average overall decrease of 0.6 units of Levemir, and an average early morning glucose level of 125 milligrams per deciliter (mg/dL). Group One (July 2012 through October 2012) results for Lantus patients were an average age of 69, an average weight of 85.7 kg, 30 females and 12 males, an average of 7.3 days of therapy, an average overall increase of 7.6 units of Lantus, an overall average decrease of 1.4 units of Lantus, and an average early morning glucose level of 144 mg/dL. Group Two (November 2012 through February 2013) results for Levemir patients were an average age of 64, an average weight of 89.5 kg, 19 females and 12 males, an average of 5.1 days of therapy, an average overall increase of 6.6 units of Levemir, an overall average decrease of 0.9 units of Levemir, and an average early morning glucose level of 141 mg/dL. Group Two (November 2012 through February 2013) results for Lantus patients were an average age of 69, an average weight of 85 kg, 24 females and 13 males, an average of 4.6 days of therapy, an average overall increase of 6.8 units of Lantus, an overall average decrease of 0.7 units of Lantus, and an average early morning glucose level of 138 mg/dL.

Conclusion: There does not appear to be an increase in insulin requirements when Lantus is replaced with Levemir. A head to head comparison between the two products, Lantus and Levemir, can be seen when the Lantus patients in Group 1 were compared with the Levemir patients in Group Two. This shows an average overall increase of 7.6 units of Lantus in Group One and an average early morning glucose level of 144 mg/dL as compared to 6.6 units of

Levemir for the Group Two Levemir Patients, and an average early morning glucose level of 141 mg/dL. Purchase history for the time of Group Two was only three vials of Lantus and eighteen vials of Levemir. This shows that the insulin unit requirements were not changed when Levemir was used vs. Lantus. Both basal insulins performed similarly relative to the early morning glucose levels.

Category: Transplant / Immunology

Title: Rates of urinary tract infections and hyperkalemia in the first 30 days after kidney transplantation comparing two sulfamethoxazole-trimethoprim prophylaxis dosing regimens

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Purpose: Urinary tract infections (UTI) are the most common bacterial infection in kidney transplant recipients (KTR) and can result in impaired graft function, sepsis, and death. The use of sulfamethoxazole-trimethoprim (SMZ/TMP) decreases UTI frequency after kidney transplantation (KT). Guidelines recommend UTI prophylaxis with daily SMZ/TMP, however optimal dosing is not known. The aim of this study was to compare the incidence of UTI in the first 30 days after kidney transplantation and compare rates of hyperkalemia between two different SMZ/TMP prophylaxis regimens.

Methods: After institutional review board approval was obtained, KTR that received either SMZ/TMP 400/80mg (SS) or 800/160mg (DS) daily between July 2007 and June 2012 were retrospectively identified. Primary endpoints were incidence of culture proven UTI and rates of hyperkalemia in the first 30 days after KT. Secondary endpoints included gender differences in UTI, estimated glomerular filtration rate (GFR), and mean tacrolimus trough concentrations.

Results: Four hundred six patients met entry criteria. Culture positive UTI were identified in 14/163 (8.6%) SS and 17/243 (7%) DS patients ($p=0.6$). Females experienced more UTI than males and 11/63 (17.5%) females in the SS cohort experienced UTI vs 9/98 (9.2%) in the DS group ($p=0.1$). Mean potassium concentrations were similar in both groups, 4.4 ± 0.4 in SS vs 4.4 ± 0.3 in DS ($p=0.5$), despite similar tacrolimus concentrations. Mean tacrolimus concentrations were 9.6 ± 1.4 in the SS cohort vs 9.6 ± 1.6 in the DS group. However, those that received DS experienced higher rates of hyperkalemia ($K > 5.5$), 37% vs 23.3% ($p=0.02$), and severe hyperkalemia ($K > 6$), 18.5% vs 9.8% ($p=0.03$), when compared to SS. Mean GFR estimates as estimated by the CKD-EPI equation were 60 ± 17 in SS compared to 55 ± 19 in DS ($p=0.03$).

Conclusion: UTI rates were higher in those treated with SMZ/TMP SS, especially female patients. However, incidence of severe hyperkalemia was higher in the DS cohort. SMZ/TMP SS should be considered in male patients, especially those with potassium balance issues since those taking SMZ/TMP DS daily are at higher risk of experiencing hyperkalemia. The risks and benefits of these formulations must be weighed carefully when selecting a UTI prophylaxis regimen after KT.

3-177

Category: Transplant / Immunology

Title: Successful renal transplantation in a patient with known idiopathic systemic capillary leak syndrome using basiliximab induction therapy

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Purpose:

Methods:

Results:

Conclusion:

Category: Women's Health

Title: Human papilloma virus (HPV): assessing and increasing awareness among the Lebanese women

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Purpose: Human papilloma virus (HPV) is a sexually transmitted pathogen that causes anogenital diseases in both males and females. Advisory committee on immunization practices (ACIP) recommends the bivalent or quadrivalent HPV vaccines for females aged 11 to 12 for the prevention of cervical, vaginal, and vulvar cancer. It also recommends the quadrivalent HPV vaccine for the prevention of anal cancer and genital warts in females. The objectives of this study were to assess the level of awareness about HPV and related diseases and to evaluate the role of pharmacist in increasing awareness about HPV diseases and prevention methods among females.

Methods: The institutional review board of the Lebanese International University approved this multicenter descriptive study that was conducted from February 2013 till April 2013. Females aged 16-60 years, and from different socioeconomic, religious and educational background were included. In several obstetric and gynecologic clinics, a questionnaire was offered to the patients before and after counseling in order to assess their knowledge about HPV. The questionnaire included 2 sections. The first section gathered personal information about the patients. The second section encompassed a series of questions about the diseases caused by HPV, means of transmission and protection. The pharmacist offered counseling both directly and through a leaflet that was written in the native language, using centers for disease control (CDC) as a reference for information. The leaflet contained information about HPV, cervical cancer, and genital warts. It also contained HPV modes of transmission and screening methods for cervical cancer, the available HPV vaccines, dosing regimen and the CDC recommendations for vaccination. In the end of the process, patients were asked if they are willing to do the vaccine. Data analysis was done by an independent medical biostatistician. The primary endpoint was to assess the level of awareness among this sample size. The secondary endpoint was to evaluate the association between educational background and level of awareness.

Results: A total of 85 patients that fulfilled the inclusion criteria, were chosen randomly. It was found that 7.4 percent (3/85) have already taken the vaccine, 68 percent (51/85) of the patients have never heard of the vaccine, 24 percent (18/85) had cost as a limitation for its uptake, 6 percent (4/85) said it was not necessary for them, and the rest was either pregnant or responded that it was a taboo to discuss this topic. After counseling, 70 percent (53/85) of the patients were

willing to take the vaccine; however, 60 percent (40/85) answered that a possible limitation is the cost. Upon comparing patients with different educational background, significant difference was found between university level patients and school drop outs; 95 percent confidence interval [0.0490 -3.623] (p value 0.042). However, after counseling, there was no difference between university level, secondary/technical school level patients and school drop outs.

Conclusion: The awareness about HPV, cervical cancer and the vaccines is still very low in Lebanon. Bigger campaigns and more governmental funding are needed in order for the vaccine to be available to the whole population. Strengthening the public health programs will lead to a general acceptance of the vaccine. Finally, since the pharmacist is the health care professional that the patient can access easily, He/she has a crucial role in spreading the awareness through counseling.

5-001

Category: Administrative practice / Financial Management / Human Resources

Title: Results of a post-interview survey of postgraduate year one (PGY1) residency candidates at a community teaching hospital

Primary Author: Lisa M. Richter, Sanford Medical Center Fargo, 801 Broadway N, Fargo, ND, 58122; Email: lisa.richter@sanfordhealth.org

Purpose: Quality improvement is a required part of the pharmacy residency program as indicated by Principle 7: Qualifications of the Pharmacy and a list of the current quality improvement initiatives are requested when applying for pharmacy residency reaccreditation. The goal of this survey was to collect general information on the number of programs current students were applying to and interviewing at, and to evaluate our interview process from the perspective of the applicants to determine if there were areas of our interview process that needed to be changed or updated as the interview format had not been evaluated previously.

Methods: A ten question anonymous survey was emailed to all 2013 residency interview candidates. The survey was emailed after the Match ranking results were released. Questions included how many programs applicants applied to, interviewed at and ranked. In addition multiple choice questions asking survey participants to rate their satisfaction or level of agreement or disagreement specific to our interview process were included. These questions included areas such as the facility, staff, online information, interview format, and resident interaction. Free text areas for comments about any of the questions posed were also included in the survey. A follow-up reminder email was sent to all interview candidates encouraging any candidates to complete the survey that had not already done so.

Results: Eleven responses to the survey were received from the 13 candidates the email was sent to (85% response rate). Fifty percent (5 of 10) of respondents who answered the question applied to more than 8 residency programs, 30% (3 of 10) interviewed at 3-4 programs and 30% interviewed at 5-6 programs. Fifty percent (5 of 10) of applicants ranked 3-4 programs. Reasons most commonly identified for not ranking our program higher included lack of opportunities for a postgraduate year two (PGY2) residency at our site and geography. All respondents indicated they strongly agreed or agreed that they were overall satisfied with the interview process at our site and all respondents indicated the interview lead them to rank the program higher or the same as they would have prior to the interview. Interviewees were asked if they would like to see rounding with a critical care or internal medicine pharmacist as part of the interview, adding a journal club or a patient case workup. Interviewees most commonly indicated they would like to round (36%), followed by a patient case workup (18%) and only one person (9%) was interested in adding a journal club (currently a fifteen minute presentation is required).

Conclusion: The results of the survey were presented at a preceptor meeting. Based on discussion benefits were not anticipated with adding rounding, patient cases or journal club to the interview as all interviewees already indicated they were satisfied with the current process. Several preceptors indicated concern about not having adequate PGY2 trained staff at our site to

support this goal of expansion. Based on this the residency advisory committee issued a statement encouraging hiring PGY2 trained pharmacists for open positions if these candidates were available. Our site was recently able to secure our second PGY2 trained pharmacist to begin in July.

Category: Administrative practice / Financial Management / Human Resources

Title: Efficacy of continuing education in improving pharmacists' competencies for providing weight management service: three-arm randomized controlled trial

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Purpose: Weight management is a new public health role for community pharmacists in many countries. Lack of expertise is one of the key barriers to counseling obese patients. The present study evaluates the comparative efficacy of three alternative continuing education (CE) meetings on weight management tailored for Iranian pharmacists.

Methods: We designed a randomized controlled trial comparing didactic lecture, lecture plus case discussion, and lecture plus small group training. Pharmacists declarative knowledge, attitudes, and competence were evaluated immediately before, immediately after and one month after each meeting via standardized questionnaires and case vignettes. Participants satisfaction was evaluated after each meeting. Data were analyzed using repeated measure analysis of variance and Chi-squared tests.

Results: Sixty pharmacists were randomly allocated to each study arm. There were no demographic differences between the arms at the baseline. The knowledge scores significantly improved for all interventions over time. At the follow-up, the small group training arm obtained significantly higher knowledge scores (P value < 0.001, effect size=0.54). The competence scores in lecture plus case discussion and lecture plus small group training improved over time (effect size 0.14 versus 0.34). Small group training resulted in significantly higher satisfaction scores ($P=0.005$). The interventions' effects on attitudes were similar.

Conclusion: This is the first study on the implementation and efficacy of various types of CE meetings for community pharmacists to provide weight management services. Lecture plus small group training resulted in better learning retention over time and higher satisfaction. Future studies should evaluate the effects of various types of CE meetings on pharmacists' behavior and their cost-effectiveness.

Category: Administrative practice / Financial Management / Human Resources

Title: Didactic lecture versus interactive workshop for continuing pharmacy education on reproductive health: A randomized controlled trial

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Purpose: Pharmacists are providing reproductive health counseling in community pharmacies. However, studies have revealed significant deficiencies in their knowledge, attitudes and skills. Thus, continuing pharmacy education (CPE) could be utilized as a valuable modality to improve pharmacists competencies. Literature shows that sophisticated, comprehensive, and long-term CPE programs are capable of improving health care providers competencies and practice. Nevertheless, short-term CPE meetings remain as one of the few available professional development opportunities in many resource-limited settings while little evidence exists on effective strategies to enhance the learning and behavioral outcomes.

Methods: In the present study, we compared the efficacy of two types of one-day CPE meetings (lecture-based versus workshop-based) on contraception and male sexual dysfunctions. A randomized controlled trial was designed and 120 volunteered pharmacists were recruited (60 pharmacists allocated to each CPE meeting). Educational content of the CPE was developed based on pharmacists perceived needs and was derived from international clinical guidelines. Small group training using simulated patients was employed in the workshop CPE. Primary outcome of the study was declarative/procedural knowledge of the participants. Secondary outcomes were participants satisfaction with CPE and their attitudes towards reproductive health. Outcomes were assessed using standardized questionnaires. Data were collected pre-CPE, post-CPE and two months afterwards. Data were analyzed using repeated measure analysis of variance and Mann-Whitney U test.

Results: Seventy one participants completed all measurement levels. Lecture-based CPE was more successful in improving pharmacists knowledge post-CPE comparing to workshop-based group ($p < 0.001$). In contrast, a significant decrease was observed in the lecture-based group at follow-up ($p = 0.002$) whereas the workshop-based group maintained their knowledge over time ($p = 1.00$). Knowledge scores of both groups were significantly higher at follow-up in comparison

with pre-CPE (p values <0.01). No significant differences were observed regarding satisfaction and attitudes scores.

Conclusion: An interactive workshop might not be superior to lecture-based training for improving pharmacists knowledge and attitudes in a one-day CPE meeting. Further studies are required to compare the effects of these educational approaches on pharmacists practice behavior.

5-004

Category: Administrative practice / Financial Management / Human Resources

Title: Strategies to improve pharmaceutical waste management practices across health system facilities in the Veterans Health Administration

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Purpose: The Veterans Health Administration (VHA) conducted a nationwide evaluation of pharmaceutical management practices to develop a comprehensive strategy to minimize risks associated with management, handling and disposal of pharmaceutical wastes generated at VHA. The strategy was to identify legal requirements, audit pharmaceutical handling and waste management practices at selected VHA health system facility sites for potential areas of improvement in procurement, product management, compliance with federal and state Environmental Protection Agency regulations under the Resource Conservation and Recovery Act, the Drug Enforcement Agency, Occupational Safety and Health Administration, VHA policy and, to identify best practices and learning opportunities for VHA.

Methods: A Regulatory Baseline Assessment was conducted to review the baseline Federal and state regulations, industry best practices, and VHA policies applicable to pharmaceutical management, in the handling and use of pharmaceutical waste. An assessment team visited and audited eleven VHA sites that were considered geographically representative of VHA's large healthcare system of 152 hospitals and 909 ambulatory care and community-based outpatient clinics, among other facilities. The audit was based on 40 Pharmaceutical Management competency requirements defined and developed from an environmental review of federal regulations, industry best practices and VHA policy. The 40 competency requirements focused on program management, product management, pharmaceutical handling and use, and waste management. Prior to site visits, each facility completed a pre-survey to help inform the assessment team on key areas. During the site visit, the team conducted a focused facility tour, including the pharmacy department, patient care wards, waste accumulation areas, and other key areas involved in the pharmaceutical management process. The team also completed a detailed document review and conducted both group and/or individual interviews as part of the data gathering process. A consolidated capability scoring matrix was established to evaluate and assess each facility, including observed issues to focus on.

Results: Prior to the site evaluations, several VHA health system facilities needed formalized policies and procedures with regard to ordering and receiving products, inventory management, monitoring procedures for performance measures, and reverse distribution of expiring

pharmaceuticals. Handling and use policies for pharmaceuticals were generally not present or not well developed, such as hazardous drug lists and required handling and training for employees. As a result of these observations the VHA developed a formulary review, pharmaceutical waste identification and segregation poster codes as well as educational fact sheets for specific drug products that were flagged as high-risk. These interventions were made to enable pharmacists to bridge gaps in training and knowledge of these practices. Furthermore, a nationwide online training program was developed within the web-based educational program of VHAs Talent Management System (TMS). This educational tool was made accessible to all VHA employees including pharmacists to develop skills towards addressing competencies, knowledge, and oversight to implement effective pharmaceutical waste management initiatives.

Conclusion: A systematic evaluation identified areas for opportunities to improve waste management practices. The assessment team provided a thorough overview of the issues observed throughout site visits in collaboration with initiatives by VHAs established Green Environmental Management System (GEMS). As a result, the GEMS Pharmaceutical Management Guidance Document was developed with recommendations, a training curriculum and performance metrics for assessing pharmaceutical management performance. Policies for proper handling and use of pharmaceuticals are essential to a comprehensive pharmaceutical management program. Pharmacists will have the tools to utilize this training curriculum at their health system facilities to manage, handle and monitor waste management.

Category: Administrative practice / Financial Management / Human Resources

Title: Estimation of the economic impact associated with pharmaceutical interventions at a university hospital in Japan

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Purpose: Pharmacists have become integral members in the medical team. The number of pharmaceutical interventions is increasing as pharmacists increase the opportunity for providing pharmaceutical care services to patients in Japan. However, the financial benefit of many pharmaceutical interventions (e.g., adverse drug event prevention and drug interaction avoidance) has not been well described in Japan. In this study, we estimated the original economic impact associated with pharmaceutical interventions by an evidenced-based approach.

Methods: We classified pharmaceutical interventions into 13 items, which included prevention of adverse drug events, drug interaction avoidance, and drug therapy consultation or recommendation according to the patient's condition. The cost saving associated with prevention of each serious adverse drug event was calculated as \$21,400 (\$1=100 yen) based on the amount of costs and the number of cases that were paid for by Pharmaceuticals and Medical Devices Agency in Japan. Pharmacokinetic recommendation of aminoglycoside and vancomycin were estimated to have a cost saving of \$1,890 based on the literature in Japan. We assigned the rates of preventing serious adverse effects related to chemotherapy orders and others as 5% and 2.5%, respectively, based on the literature (J Trauma Acute Care Surg. 2012 73(6) 1484-1490). Using this rate for prevention of adverse drug events, the values of intervention related to chemotherapy orders and others were \$1,120 (5% of \$21,400) and \$560 (2.5% of \$21,400), respectively.

Results: The number of interventions was over 1200 per year, including 3 preventions of serious adverse drug events, 114 pharmacokinetic recommendations of aminoglycoside and vancomycin, 39 interventions of chemotherapy, 52 avoidances of drug interaction, 23 drug therapy consultations or recommendations on renal function, 710 drug information to medical staff, and over 300 of other interventions. According to the number of interventions, we calculated that the total cost saving associated with pharmaceutical interventions was \$480,000.

Conclusion: This is the first study to estimate the economic impact associated with pharmaceutical interventions of pharmacists in Japan. Evaluating pharmaceutical interventions in

relation to the economic impact is an important method for assessing the role of pharmacists in the hospital.

5-006

Category: Administrative practice / Financial Management / Human Resources

Title: Improving communication with the C-suite through the development of a quarterly pharmacy services business report and dashboard tool

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Purpose: Given the size and the scope of our department we identified the need to develop a standardized mechanism to communicate key performance metrics to the C-suite. The goal of this project was to develop a dashboard of key metrics that represent the department productivity, services provided, and how they align with organizational strategic goals. The dashboard metrics will be used to develop a formal business report that can be shared with C-suite members to improve communication and comprehension of our services.

Methods: The pharmacy leadership reviewed available data to define key performance metrics which align with our organizational strategic goals (quality leadership, growth and financial stewardship, care innovation and integration, academic innovation and organizational engagement). Once defined, data was gathered for each of the metrics and transformed into graphs for inclusion in the dashboard. The graphs are further described with key summary information, definitions, and explanations for outlying data points which would be helpful to reviewers unfamiliar with our performance metrics. This dashboard will be shared twice per year with the members of the performance improvement council committee. From these graphs, several key financial, productivity and clinical quality metrics were identified as items that were of significant importance to elaborate and further describe in a quarterly business report that will be shared with C-suite members.

Results: The metrics included in the dashboard were defined for each of the strategic goals. Inpatient dispensing events per 1000 patient days, clinic pharmacy dispensing events per 10,000 prescriptions, and antimicrobial stewardship initiative cost savings were included to represent quality leadership. Financial stewardship metrics include inpatient order verification volume, medication quality pharmacy interventions and cost avoidance, inpatient doses dispensed, labor expense per pharmacy intensity score (PIS), hours worked per PIS, and a cost savings initiatives summary. Strategic growth goals include clinic pharmacy prescription volume and pyxis machine to technician ratio. Employee turnover represented organizational engagement and the academic innovation goals included investigational drug services activities, pharmacy services publications and research, and an experiential education overview (number of pharmacy students and PGY-1 and PGY-2 residents). Ambulatory pharmacy services (discharge concierge program and heart failure discharge counseling services) represent the impact on the organizations care innovation and integration goal. The quarterly business report was reviewed with the COO and SVP of Patient Care Services twice during 2012. Additional metrics included overall drug

expense performance, drug expense per pharmacy intensity score discharge, and the top 15 hospital based drugs.

Conclusion: The development of a standardized mechanism to communicate the department performance metrics in the form of a dashboard and business report were useful tools to help increase the visibility and understanding of pharmacy department services for members of the C-suite. We have also begun to regularly post this data internally and discuss the information with the Pharmacy staff to increase engagement and understanding of how our services align with organizational goal performance.

5-007

Category: Administrative practice / Financial Management / Human Resources

Title: Implementation of a multidisciplinary pharmacy committee to prioritize pharmacy practice model initiative (PPMI) self-assessment action planning

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Purpose: As the goals of the organization continue to focus on more direct patient care activities, pharmacy leadership recognized the need for continued development and advancement of our clinical practice model. Additionally, the Pharmacy department has begun a master facilities project encompassing a new location, expanded space and new work flow opportunities. We utilized the pharmacy practice model initiative (PPMI) self-assessment results to support the creation of a multidisciplinary pharmacy group. This goal of this team is to design an optimal practice model for Pharmacy Services that will expand support our mission and vision and help guide our master facility project.

Methods: The acute care pharmacy leadership team developed a committee charter and identified key committee representatives; members include clinical specialists, clinical pharmacists, technicians, executive leadership, pharmacy leadership team members, and ad hoc members from the other pharmacy departments in the health system. Interested staff members were asked to submit a brief application and the chief pharmacy officer was asked to participate as the executive sponsor. The committee's first task was to develop a project mission and vision statement. Once completed the group began work on reviewing and prioritizing the self-assessment action plan to best support the practice model redesign, which included retaking the PPMI self-assessment as a group. This work has coincided with preliminary design meetings with an architecture firm and several site visits to other like-size organizations to begin gaining an understanding of how other pharmacy space designs and accompanying technologies have helped support and drive practice models.

Results: The PPMI committee was officially formed in October 2012. The group meets every two weeks for two hours in the evening. The robust and diverse committee membership has helped drive immediate practice model changes. These include engaging health-system executives in discussions to advance pharmacy practice, the development of a project mission and vision statement and decentralization of clinical pharmacists. The initial decentralization of these pharmacists did not address or identify additional patient care activities. Thus the committee has begun designing clinical initiative expectations for the unit based pharmacy staff and will begin implementing these tasks in the next few months. Committee members have also been involved in site visits and are beginning to evaluate technology and automation to support our practice model and space expansion. Lastly, the pharmacy committee is collaborating with

the department of Process Improvement to apply Lean Six Sigma principles to identify waste and improve medication safety.

Conclusion: The creation of this multidisciplinary committee has improved employee engagement, identified the need for practice model transformation, and allowed for collaborative tests of change to processes and workflows. Attendance and contributions to the committee has remained high, likely due to the inclusion in decision-making and participation in change actions. The committee is utilizing the PPMI self-assessment information to help guide and prioritize practice model changes.

5-008

Category: Administrative practice / Financial Management / Human Resources

Title: Economic impact of a therapeutic interchange for ipratropium bromide/albuterol sulfate inhalers in a safety net medical center

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Purpose: The pharmacy department is always evaluating cost containment opportunities and reviewed the anti-asthmatic and bronchodilator agents. Our facility is a 462 occupied bed, level 1 safety net medical center. The purpose of this project was to review usage, implement and streamline the use of agents within this class with the implementation of a therapeutic interchange.

Methods: Review cost and purchase data for anti-asthmatic and bronchodilator agents and develop a therapeutic interchange protocol for ipratropium bromide/albuterol sulfate inhaler to albuterol sulfate inhaler or nebulization for ventilated patients. Joint meetings with the ICU intensivists, Chief Medical Quality Officer, pharmacy, and respiratory therapy provided us a roadmap to change our current practice. Education was provided to providers, pharmacy, and respiratory therapy staff. Alerts were incorporated into the electronic health record and CPOE system. Pharmacists coordinated the changes in therapy for each patient.

Results: Purchase data identified that anti-asthmatic and bronchodilator agents had increased 27 percent year over year ending December 2012. The interchange to albuterol sulfate was approved by an ICU physician team, the Pharmacy and Therapeutics Committee and implemented January 2013. After the first four months of implementation, drug spend in this therapeutic category decreased by 50 percent (\$89,800 per month vs. \$44,540 per month). Ipratropium bromide/albuterol inhaler expenses dropped by 79 percent. The data is not adjusted for seasonal variation, however when evaluated per patient day, our expenses for the therapeutic class have dropped from \$8.48 per patient day to \$3.09 per patient day. Our use of albuterol has stayed relatively constant with a slight increase in nebulization.

Conclusion: The implementation of a therapeutic interchange for ipratropium bromide/albuterol sulfate inhaler resulted in a significant savings at HCMC. Based on the first 4 months, we anticipate our savings to top \$150,000 this year. There is an opportunity to evaluate this class of agents for a savings opportunity.

5-009

Category: Administrative practice / Financial Management / Human Resources

Title: Justification of future drug expenditures based on historical usage patterns

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Purpose: Drug expenditures continue to be evaluated in order to solve for new ways to decrease the budget. Hennepin County Medical Center (HCMC) is a 462 occupied bed, safety net medical center which includes a level 1 adult and pediatric trauma center. By developing a consistent approach to predict the hospitals annual drug spend, HCMC is able to accurately plan for future drug expenses. The purpose of this project was to review the top therapeutic drug class expenditures as compared to the recommended national average predicted increases to facilitate the budget for the following fiscal year.

Methods: Using purchase data, historic inflation, and a customized report for the top drug classes; we evaluated the usage patterns to determine the drivers of the drug costs within each class. If the costs were driven by 2-3 agents, those agents were looked at independently. If the spend was evenly spread throughout the drug class, the national drug price forecast tool was used. The top 10 therapeutic classes (by expense) were reviewed and provided the data for approximately 60 percent of our total drug spend of \$20 million.

Results: The 2013 budget was evaluated using year over year spend, ending July 2012 for the top ten therapeutic categories. The top 10 categories include: 1. Hematological Agents 2. Antiasthmatic & Bronchodilator Agents 3. Anti-infective Agents 4. Antipsychotics & Antimanic Agents 5. Anticoagulants 6. Assorted Classes 7. Passive Immunizing Agents 8. Dermatological Agents 9. Analgesics-Opioid 10. Endocrine and Metabolic Agents. The drug price inflation summary projections ranged from 1.8 to 9 percent change (median was 5) for the categories. Our hospital specific actual percent change ranged from negative 18.4 to 20.8 (median was 9.2). A limitation of this budget process was the estimate used to determine the impact of future generic release dates and the net price 6 to 12 months in advance. The estimates were every close to the current spend for the top 3 therapeutic classes. However, the Antipsychotic and Anticoagulant budget projections were not as accurate for either the budget process or the national drug price forecast tool because the generics were released at a much larger discount than forecasted. Thus the impact to our organization has been favorable. To date, we have not completed an analysis on a per patient day basis.

Conclusion: Using the specific usage trends, allows a more accurate budget for the pharmacy department. This method provided specific information that made it easier to respond to finance questions about reducing the drug spend. National drug price forecast tool projected drug price

inflation and new drug costs at 3.8 percent growth in the drug budget. Our model, based on actual purchasing and inflation history, projected a 7.3 percent overall increase. Hospitals should consider using this process for their top spend drugs and/or therapeutic classes.

5-010

Category: Administrative practice / Financial Management / Human Resources

Title: Economic impact of oncologist and pharmacy collaboration on costs of care and therapeutic agents at CHRISTUS Spohn

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Purpose: CHRISTUS Spohn Shoreline is a 600 bed hospital, with an average daily census of about 350 patients. The pharmacy annual drug budget is 15.2 million dollars, with about 350 thousand dollars per month spent on oncology drugs. In late 2012, the institution became concerned about the continuous surge in the costs of oncology drugs. At that time it was estimated that the amount spent would exceed 400 thousand dollars per month by the end of the fiscal year. The department of pharmacy was encouraged to evaluate the reasons for the surge, and provide solutions.

Methods: A multidisciplinary task force was formed as a result, to determine reasons for the surge. The task force included administrators, clinicians, and financial officers. Upon review of the available oncology data an opportunity for pharmacy to collaborate with one of the oncologists, who managed approximately fifty percent of the inpatient and outpatient cancer patient populations was identified. Subsequently an oncology clinical pharmacy specialist was assigned to work with the oncologist, in both the inpatient, and outpatient settings. From January 2013, the clinical pharmacy specialist began rounding with the physician to optimize drug use. The physician and clinical specialist worked in areas such as utilization of the 340-B and medication assistance programs in the outpatient setting, appropriate dosing and utilization of colony stimulating factors, antiemetics, antimicrobial agents, and conversion of patients to oral chemotherapeutic agents when feasible. Financial data was tracked over the subsequent five months.

Results: In December of 2012, the inpatient average cost per case for physician collaborator was approximately 12,800 and 6,200 dollars for the other (four) oncologists respectively. By the end of April 2013, the average inpatient cost per case for the physician collaborator was 8,800 dollars, and 8,500 dollars, for the other oncologists. In December of 2012, the outpatient census for the physician collaborator was 247 patients and 344 for the other oncologists. The average cost per outpatient case for the physician collaborator in December 2012 was approximately 2,400 dollars and 1750 dollars for the other oncologists. In April of 2013 the census for the physician collaborator was 368 compared to 536 for the other oncologists. The average cost per patient however dropped to approximately 900 dollars for the physician collaborator, and to

1,900 for the other oncologists. The amount spent on oncology drugs in October of 2012 was about 445,000 dollars, and declined to 355,000 dollars in April of 2013. The overall pharmacy cost per patient per month in oncology in December of 2012, was approximately 2,100 dollars, and declined to 1,400 dollars by May of 2013.

Conclusion: These data demonstrate that collaboration between clinical pharmacists, oncologists, and hospital administration, results in oncology drug savings, especially in this era of expensive therapies, such as monoclonal antibodies, growth factors, and antiemetics in hematology-oncology. Such collaboration also appears to have implications in the overall costs of care, in oncology.

Category: Administrative practice / Financial Management / Human Resources

Title: Assessing fourth professional year Doctor of Pharmacy students' attitudes about a new residency/fellowship preparation program

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Purpose: The number of postgraduate year 1 (PGY1) residency training programs is much lower than the annual number of graduating pharmacy students; this is expected, as many graduates do not pursue postgraduate training. Over the past few years, competitiveness for obtaining a residency or fellowship has increased. As a result, the Department of Pharmacy Practice began offering a Residency/Fellowship Preparation Program (RFPP) to help interested fourth professional year Doctor of Pharmacy (PharmD) students better prepare for navigating the complex and competitive process. This project explored whether the newly implemented program provided useful assistance during the residency/fellowship process.

Methods: A survey of the 2013 PharmD graduates was conducted via SurveyMonkey®; all graduating PharmD students were included since some students may have used the preparation tools and not sought residency or fellowship training. The survey was voluntary and completed anonymously by participants who were at least 18 years of age. The survey was granted exempt status by the Institutional Review Board. The survey was designed to characterize the usefulness of the enhanced preparation and tools provided by the Department of Pharmacy Practice, asking specifically about each offering. The survey asked whether or not a residency or fellowship was obtained and which portions of the RFPP were utilized (e.g., information session, curriculum vitae review, mock interviews, letter of intent review). A 5-point Likert scale was used to assess helpfulness of each resource (strongly agree to strongly disagree) and participants were asked to rank the usefulness of each resource with “1” being the most helpful. Additional comments were sought about the provision of the program and for resources and tools that would be considered important additions to the program. Descriptive statistics were used to summarize data collected.

Results: Through self-report by the 2013 graduates, 25 matched with a residency program, 3 scrambled to obtain a residency, and one obtained an industry fellowship; 97 PharmD degrees were awarded. Of the graduating class, 30% obtained a residency or fellowship. All 97 graduates were emailed the survey; 36 participated in some portion of the survey. Of the respondents, 32 (72.2%) pursued residency/fellowship training; 22 (61.1%) matched. Thirty-two (89.9%) respondents indicated participation in the RFPP. Of the respondents, 27 (81.8%), 26 (78.8%), 25 (75.8%), 24 (72.7%), and 23 (69.7%) strongly agreed or agreed that provision of curriculum vitae review, on-site residency/fellowship advice at the ASHP Midyear Clinical Meeting, web-based preparation tools, residency/fellowship information sessions, and letter of intent review assisted in navigation of the residency/fellowship process, respectively. Fewer respondents indicated that mock interviews (n=19; 57.6%), post-match information sessions (n=15, 45.5%), and scramble advice (n=11, 33.3%) were helpful. Suggestions for improvement to the RFPP were to: offer more guidance on how to use PhORCAS; coordinate faculty to allow provision of

CV review, mock interviews, and reviews of letter of intent and interview presentations for the same student; provide guidance on how the match process works; and expand information provided about fellowships.

Conclusion: A structured program to assist fourth professional year Doctor of Pharmacy students navigate the residency/fellowship process was considered useful by the students. Curriculum vitae review, on-site advice at the Midyear Clinical Meeting, and web-based preparation tools were identified as the most helpful components of the Residency/Fellowship Preparation Program. Suggestions for improvement by the 2013 graduates will be incorporated into the program.

5-012

Category: Administrative practice / Financial Management / Human Resources

Title: Defining new Pharmacy Service Metrics, a welcome outcome from Healthcare Reform

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Purpose: The accurate measurement of pharmacy productive has been a long-standing concern for most pharmacy leaders in Health Systems. New healthcare reform programs have added additional resource challenges beyond traditional metric models. Patient satisfaction, physician satisfaction, expense management, and electronically tracked quality outcomes validate an overhaul of pharmacy metrics. The new pharmacy metric model attempts to align organizational needs moving the department centric model to the organizational focus model. The new model adopts several outcomes that compliment sustainable metrics as pharmacy practice supports the new Pharmacy Practice Model Initiative.

Methods: Charged with reducing expenses by four percent, the pharmacy program could not longer create value by traditional methods of formulary management. A new method for tracking labor, pharmaceutical expense, and departmental expense was introduced during the last budget cycle. Previously, the pharmacy was benchmarked against "similar" organizations providing services and programs comparable to our facility. Variability was a consistent outcome which generated questionable validity of data sets with both our hospital and national benchmarks. The new model utilizes an incentive program that targets 5 pillars of success. Multiple drivers include adjusted patient days per pharmaceutical expense as compared to monthly benchmark data. We used internal data comparison elements over pervious year data for trending error reduction within our organization. National Hospital Compare data was used for quality compare groups as identified by hospital teams versus individual department silo trending efforts.

Results: The last twelve months utilized a new transitional model that will be expanded to full implementation of the new model for the fiscal year 2014. Although improvements were not found in all five pillars, we were able to reach success in key areas such as our financial goal (four percent reduction), patient safety goal (twelve percent improvement), physician satisfaction (four percentile improvement), but only had modest improvement for patient satisfaction (no change) and employee engagement (two percent improvement).

Conclusion: Senior leadership acknowledged the success for the new model and supported an eight full-time employee addition to continue expanding the model. The five pillar incentive program complemented future strategic initiatives for our organization. Previous traditional models for labor management (doses or order counts per defined denominator) did not support our organizational goals. Ongoing efforts will target the value proposition where reducing

expense, improving quality will generate value for the organization. The Pharmacy Practice Model Initiative (PPMI) with provider status will compliment this new pharmacy metric program validating rationale for new metrics in health system pharmacies.

5-013

Category: Administrative practice / Financial Management / Human Resources

Title: Pharmacy Staff Perceptions and Satisfaction towards the standardized Orientation Program at The Heart and Cancer Centers in Qatar

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Purpose: To study pharmacists and pharmacy technicians perceptions and satisfaction towards the structured pharmacy orientation program for newly hired staff at the Heart and Cancer centers in Qatar.

Methods: A cross-sectional, observational study was conducted at the heart and Cancer centers from Januray 2010 to April 2013 using piloted, validated, online, and anonymous questionnaire. The questionnaire consisted of 3 parts; pharmacy staff socio-demographic and practice characteristics , 8 perceptions statements related to the orientations site , 11 perception statements related to the mentors, overall satisfaction question. All statements with 5 points scale. The self- administered survey was distributed to 64 pharmacy staff upon the completion of their orientation program using Survey Monkey. Data was analyzed using descriptive statistics.

Results: A total of 64 pharmacy staff, 42 pharmacists and 22 pharmacy technicians completed the survey giving a response rate of 100%. 56 (88%) of respondents agreed that the orientation at the site was adequate , 60(94%) of pharmacy staff agreed that the mentor provided constructive criticism on interpersonal skills with staff and patients whenever needed, 59(92%) of pharmacy staff agreed that the mentor displayed professional attitude and motivation. The overall pharmacy staff satisfaction towards the orientation program was 94%

Conclusion: The pharmacists and pharmacy technicians perceptions and satisfaction were significantly high with the structured pharmacy orientation program upon the completion of their orientation. According to their feedback the orientation to the site was adequate and the orientation manual was more helpful.

5-014

Category: Automation / Informatics

Title: Advantages of using a computerized prescriber order entry of parenteral nutrition

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Purpose: The use of Parenteral Nutrition (PN) is complex and involves several stages susceptible to errors that can cause undesired effects on patient. The presence of several components and different requirements for each patient make prescription a complex stage as it involves calculations regarding nutrient content and different doses and adjustments according to the patients age, weight and clinical conditions and restrictions due physicochemical stability of the formulation. The aim of the study was to identify the advantages of using a Computerized Prescriber Order Entry (CPOE) of PN and evaluate if its use reduces the need for intervention performed by the pharmacist.

Methods: It was conducted a retrospective study, based on the report of the pharmaceutical interventions for prescriptions forwarded to an outsourced Brazilian company that produces PN, conducted between August 2010 and April 2011. A questionnaire was also applied in 2012 to pharmacists responsible for identifying which interventions were performed, both in the handwritten forms, as well the electronic system. In Brazil, the indication and prescription of PN are medical assignments. Among other tasks, the pharmacist makes a pharmaceutical assessment of the prescription. The physician send the prescription via L-Fax (paper form) or via electronic system to the outsourced company and then the pharmacist evaluates and requests changes to the composition if its not in accordance with the analysis criteria adopted. It was analyzed the pharmacotechnical and clinical interventions of PN prescriptions received by L-fax made by clinical pharmacists. The main reasons for the interventions made on the faxed prescriptions were identified and compared to warnings that prevent the continuity of the prescription by the CPOE

Results: In the 9-month period were performed 2,832 interventions (10,3 interventions/day) approximately 2.3% of all daily prescriptions (average of 450 - computerized system + L-Fax). The main causes of interventions were: an excess of calcium and/or magnesium with risk of phase separation of the lipid emulsion (57%), difference in final volume (18%), inadequacy between osmolarity calculation and indication of the access means (6.8 %), excessive concentrations of calcium and phosphate with risk of precipitation (4.4%) and the nutrient amount (TNA) (2.8%). With the questionnaire it was found that most interventions occur due to

illegibility problems of handwritten prescriptions. All of the clinical interventions were made regarding the recommendation for trace elements and multivitamins. The average time taken to contact the prescriber was 45 minutes and the contact duration of 2 minutes. The online tool of prescription performs the interventions simultaneously to the typing prescription (89%) through alert messages of clinical or pharmacotechnical impediments.

Conclusion: Using the CPOE reduces the number of interventions made by the pharmacists team and contributes to patient safety, as it performs both clinical and pharmacotechnical evaluation of the prescription. The CPOE has dynamic warning and impediment messages that assist the physician and ensure that the final formulation prescribed is in accordance with required parameters, reducing the prescription time and eliminating miscalculations. The use of this system contributes to the reduction of errors, illegibility and missing information. Additionally, this tool helps in calculating doses and provides various reports with information to prescribers about the evolution and history of the patient.

5-015

Category: Automation / Informatics

Title: Keeping up with technology: determining interest among future pharmacists for an elective telemedicine course

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Purpose: Telemedicine is a cost-effective method providing general and specialized healthcare needs to patients in remote/rural locations. Healthcare providers need to adapt to the ever evolving technological advances to provide care to underserved patients. Pharmacy continues to evolve, as future pharmacists practice in numerous healthcare settings, including telemedicine. In pharmacy school, exposure to telemedicine is minimal to none. The objective of this study is to determine student interest in selecting a telemedicine elective course and determine the baseline knowledge of telemedicine between first to third year pharmacy students at a college of pharmacy (COP).

Methods: A Google Docs survey was created and emailed to first, second, and third professional year pharmacy students from 7/16/2012 to 8/30/2012. The intent was to determine if there was any interest in enrolling in a new 15 week elective course on telemedicine. The anonymous survey assessed the students' interest and baseline knowledge of the subject. It contained a range of 5 to 8 questions as subsequent questions were dependent on the students' answers to previous questions. This facilitated a logical flow of questions compared to a set of standard questions. Students responding with interest were also asked to share the reason(s) for their interest. Those demonstrating no interest in enrolling in such a course and having no knowledge of telemedicine were given a brief overview of telemedicine in the survey and then assessed again regarding their interest and expectations for the course. The responses were documented in Excel. Descriptive analysis was utilized. This study has been IRB approved.

Results: A 25% response rate was achieved (111 out of 450 students) after forwarding the survey three times. There were 14 (13%) first, 49 (44%) second, and 48 (43%) third professional year pharmacy students who responded. Eighty-percent (n= 89) expressed an interest in enrolling in the proposed elective with 79% (n=70) indicating a lack of prior knowledge of telemedicine. Twenty-percent (n= 22) expressed no interest in the course (i.e., no interest, inapplicable to personal career path). Of those who shared no interest in the elective, 77% (n= 17) had no prior knowledge of telemedicine. Students who stated familiarity of telemedicine indicated a brief exposure to it in a COP course or have been in a telemedicine setting through work. When asked to explain their interest, 65% wanted to learn more about the topic, 50% wanted to develop skills related to telemedicine, 39% were purely curious, 32% were interested in gaining more elective hours, and 3% had other reasons (i.e., consideration as a career option, complement their educational background, possibly provide an edge over other applicants in this competitive time).

Conclusion: Among sampled pharmacy students, there is a strong desire to learn about telemedicine and its applications due to unfamiliarity in this unique practice setting. Most students expressed an interest to learn about telemedicine and its technological advances and its potential to improve healthcare needs. It is crucial to prepare and expose future pharmacists to the various healthcare practice settings, including telemedicine, which has been demonstrated to improve quality and access to care. As telemedicine gains momentum, a telemedicine elective course would prepare pharmacy students for such future directions in health care and provide a competitive edge over other healthcare professions.

5-016

Category: Automation / Informatics

Title: Evaluating a Process to Minimize Unnecessary Alerts in a Computerized Prescriber Order Entry (CPOE) System

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Purpose: Alert fatigue results when prescribers are repeatedly exposed to warnings that cause them to ignore important warnings or reminders within a computerized physician order entry (CPOE) system. This fatigue could adversely affect patient safety. Conceptually, interrupting prescribers only for clinically significant alerts may increase attentiveness to alerts. North Mississippi Medical Center (NMMC) launched a new CPOE system in October 2012 at the Tupelo campus. In attempt to reduce the number of unnecessary alerts, a process for reviewing alerts and alert databases was implemented.

Methods: A subcommittee of the Pharmacy and Therapeutics (P&T) Committee at NMMC was created to make recommendations for addressing alerts. This subcommittee consisted of Pharmacy Residents, Clinical Pharmacy Specialists, and Pharmacy Informatists from the Pharmacy and Information Technology Departments. Prior to implementation of CPOE at the NMMC Tupelo campus, this subcommittee retrospectively reviewed alerts that were generated at affiliate hospitals from January 2012 to August 2012 where the new CPOE system was previously launched. In addition to this review, a comprehensive review of the CPOE system's drug-drug interaction (DDI) database was completed. After launching CPOE at the NMMC Tupelo campus, alert data was retrospectively reviewed for the entire NMMC enterprise. DDI compendia, FDA Safety Alerts, and practitioner expertise were all used to evaluate alerts and develop recommendations. All subcommittee recommendations were vetted through the NMMC P&T and Medical Executive Committees for final approval.

Results: Prior to launching the new CPOE system at the NMMC Tupelo campus, 2,135 pairs of possible severe DDI alerts were suppressed. The most common pairs of duplicate alerts were also evaluated. DDI and duplicate alert totals and number of orders entered for the NMHS enterprise were collected at baseline then monthly. At implementation in October 2012, the average number of combined DDI and duplicate alerts was 775 per day (DDI alerts = 169 per day; duplicate alerts = 606) with an average of 3,840 orders entered per day. As the result of ongoing review and monthly recommendations by the subcommittee, the number of combined alerts decreased to 345 per day (DDI alerts = 139 per day; duplicate alerts = 206 per day) while the average number of orders entered increased to 4,121 in April 2013.

Conclusion: Developing a P&T subcommittee comprised of pharmacists to review alerts and alert databases to develop recommendations for managing alerts is an effective means to reduce unnecessary alerts.

5-017

Category: Automation / Informatics

Title: Terror on error: reducing errors associated with admission medication reconciliation using a pharmacy-managed model and CPOE

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Purpose: Computerized provider order entry (CPOE) has improved legibility of prescribed medications. However, one unintended consequence has been reduced verbal communication between providers and clinicians, particularly regarding order clarification. In our CPOE system, nurses are responsible for obtaining a medication history prior to the provider reconciling and ordering the home medications. If medications in the history require additional clarification, the provider can still place an order without realizing that clarification is still needed. The purpose of this project was to determine if a change to a pharmacist-managed model would reduce errors associated with admission medication reconciliation in a CPOE system.

Methods: Approximately 6 months after conversion to CPOE, a multidisciplinary team met to address admission medication reconciliation (AMR). Using a large screen monitor, each discipline (Emergency room nurse, admitting nurse, admitting physician, and pharmacist) demonstrated visually their role in AMR. Twenty-three separate action steps were counted in the current AMR process. It was revealed that each discipline had different privileges within the medication history and AMR, and that there were many misperceptions regarding each disciplines role. One revelation was that nurses and providers could place patient-specific information in an order comments field, which was not readily viewable by the pharmacist. Also, the provider needed to have an accurate medication list at the time of admission, and did not want to wait until the admitting nurse performed the medication history on the unit. The decision was made to place a pharmacist with nurse computer privileges in the emergency department to learn the current process. The pharmacist obtained the medication history directly from the patient or family, and supplemented this information by contacting outside pharmacies, clinic databases or nursing homes. The pharmacist then recommended changes, which resulted in an improved medication history process and involved fewer clinicians, while saving time and improving accuracy.

Results: Over a 2 week period, the pharmacist performed 124 patient medication histories, utilizing the current methodology followed by the nurse. This involved a pull forward of the

medication list from the last admission. The 124 patients had a sum of 1280 medications in their medication history, for an average of 10.3 medications per patient, with a range of zero to 39 medications per patient. Of the 1280 medications pulled forward, only 857 (67%) were correct. 248 of these medications were no longer being taken by the patient. 306 new medications were added, and 175 medications needed some sort of change to the order (dose, frequency, etc). The pharmacist outlined a new process, which reduced the number of action steps from 23 to 7. The new design prohibits the pulling forward of any medication that the patient no longer takes, or any medication with errors in the order sentence. Those medications are discontinued so that there is no risk of being accidentally ordered by the provider. The new design also recommends that the medication history be completed prior to placing the admission call, so that the provider has an accurate medication history with which to make decisions regarding inpatient orders.

Conclusion: This project revealed that our AMR process in CPOE was very disjointed. Because the AMR process involved at least 4 clinicians per patient, it was being performed by thousands of employees, who were incorporating old unsafe practices, such as pulling the medication list from a previous admission forward, with the new practice of AMR via CPOE. Concerns about missing doses of critical medications, and the risk of receiving discontinued medications or wrong doses can be eliminated by designating a specialist to perform an accurate medication history prior to contacting the admitting provider so that the ordered medications are correct.

5-018

Category: Automation / Informatics

Title: Assessment of Nurses Perceptions and Satisfaction Towards the Use of Automated Dispensing Cabinets in the Heart and Cancer Centers in Qatar

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Purpose: To assess the nurses perceptions and satisfaction towards the use of the Automated Dispensing Cabinets (ADC) at Heart and Cancer center in Qatar

Methods: A cross-sectional study was conducted at the Heart Hospital on May, 2012 and at the Cancer center on November, 2012 using piloted, validated, online, and anonymous questionnaire. The questionnaire consisted of four parts; Nurses socio-demographic and practice characteristics, 21 perceptions questions (i.e. related to training, safety, medications availability etc) with 5 points scale, an overall satisfaction question with 4 points scale and, easiness of the system question with 4 points scale. The self-administered survey was distributed to 503 nurses who were working at the heart and cancer centres over three weeks using Survey Monkey. Data was analyzed using descriptive statistics.

Results: A total of 403 nurses completed the survey giving a response rate of 80%. A total of 94% nurses agreed that the medication delivery system allows them to do their job more safely, whereas 363 (90%) nurses agreed that they now spend less time waiting for medications that come from pharmacy than before ADC system was installed. 349 (87%) nurses agreed that they are able to administer medications more efficiently with the ADC system. The overall satisfaction (very satisfied and satisfied) over both hospitals was 91%.

Conclusion: The nurses perceptions and satisfaction were significantly high with the use of the ADCs over six months period of time after complete implementation and integration in the heart and cancer centres. According to their feedback patient safety was increased and delay in medication delivery was improved.

5-019

Category: Automation / Informatics

Title: Novel implementation of electronic medication administration in the intensive care unit

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Purpose: To improve safety and quality of patient care by upgrading from paper medication administration record (MAR) to electronic medication administration record (eMAR) incorporating positive patient identification (PPID) and positive medication identification (PMID) using barcode medication administration (BCMA) in the intensive care units (ICU) of a large tertiary care hospital.

Methods: A Plan-Do-Study-Act (PDSA) approach was implemented for this rapid performance improvement project. A time-line was established and an interdisciplinary team was recruited to lead the project. Several interdisciplinary team meetings were held to establish goals, questions, equipment, and training. Site visits to two sister hospitals who had already implemented this technology in the ICU's were organized. A novel hybrid paper and electronic system was developed to aid in the transition from paper MAR to eMAR. PPID, PMID, BCMA and hybrid paper/eMAR were implemented in two ICU's for three weeks to pilot before going live in the other 7 units. A "glitch book" was implemented to record all problems and resolutions as well as used to monitor goals.

Results: The pilot ICU's and subsequent ICU's went live on time. Pharmacists were available on each unit during go-live facilitate and answer questions and additional pharmacy support was available 24 hours a day from the critical care pharmacy. Four weeks after the last unit went live, PPID was at 98% and PMID was at 91%. Several issues were identified utilizing the glitch book. Those with a large impact on pharmacy included lack of barcode on certain products, products that would not scan properly, and order sets that were not pre-built into the system.

Conclusion: The PDSA format for this project implementation worked well for both planning and following up as the project progressed. The interdisciplinary team aspect was crucial to the success of the project due to the large impact on many different departments. Communication between and within departments was also key due to the multitude of changes taking place in a short period of time. Pharmacy played a critical role in facilitating the new medication documentation process utilizing the hybrid system. The critical care pharmacy was required to adjust the staffing model to accommodate the workload. PPID, PMID, and eMAR reduced errors in medication administration, improved medication monitoring, and serve as a solid foundation for transition to computerized prescriber order entry (CPOE).

5-020

Category: Cardiology / Anticoagulation

Title: Evaluating the safety and efficacy of a heparin protocol for the treatment of venous thromboembolism (VTE) in the morbidly obese

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Purpose: Studies demonstrate that heparin dosing guidelines for the treatment of VTE may result in supratherapeutic activated partial prothrombin time (aPTT) levels in the morbidly obese. Decreased infusion rates allowed these patients to reach therapeutic levels while minimizing potential adverse events. Based on these findings, our institution updated its VTE heparin protocol to decrease the initial infusion rate from 18 units/kg/hr to 14 units/kg/hr in patients with a body mass index (BMI) greater than or equal to 40 kg/m². The purpose of this study was to evaluate the safety and efficacy associated with a VTE heparin protocol adjusted for morbid obesity.

Methods: This was an Institutional Review Board approved, single-center, retrospective cohort study from July 2012 to March 2013. Subjects were included if they met the following inclusion criteria: age greater than 17 years, heparin ordered using the non-cardiac heparin protocol for BMI greater than or equal to 40 kg/m², and at least 2 aPTT levels reported after baseline post initiation. Subjects that were pregnant or had the heparin infusion held for indications other than per protocol were excluded. Data was collected from the start of the heparin infusion until 48 hours post-initiation. The primary endpoint of the study was time to a therapeutic aPTT (60-93 seconds). Secondary endpoints included: heparin infusion rate required for the first therapeutic aPTT, percentage of subjects reaching a therapeutic aPTT within 24 hours, and any documented adverse drug events such as VTE recurrence and bleeding. Major bleeding was defined as a decrease in hemoglobin of 2 g/dL with a subsequent transfusion of 2 units of pack red blood cells.

Results: A total of 19 subjects met the inclusion criteria and were evaluated in the study. Twelve (63%) were male and the median age was 59 years. The median BMI was 59 kg/m² (range 39-87). The primary endpoint was assessed in 13 subjects who reached a therapeutic aPTT within the 48 hour data collection period. The median time to therapeutic aPTT was 12 hours (range 6-32). These subjects were included in the analysis of the secondary endpoint of the heparin infusion rate required for the first therapeutic aPTT. Four (31%) subjects required a rate of 10 units/kg/hr, 5 (38%) required a rate of 14 units/kg/hr, 3 (23%) required 16 units/kg/hr, and 1 (8%) required 18 units/kg/hr. The secondary endpoint of percentage of subjects reaching a therapeutic aPTT value within 24 hours was analyzed in 17 subjects who were on the infusion for at least 24 hours. Twelve (71%) subjects reached a therapeutic aPTT within 24 hours. There were no adverse drug events reported during the study period.

Conclusion: A VTE heparin protocol adjusted for morbid obesity is both safe and efficacious. Our institution will continue to utilize an initial infusion rate of 14 units/kg/hr for patients with a BMI greater than or equal to 40 kg/m².

5-021

Category: Cardiology / Anticoagulation

Title: Safety, effectiveness and cost analysis of rivaroxaban versus fondaparinux for thromboprophylaxis after joint replacement at an inpatient rehabilitation facility

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Purpose: The purpose of this study is to compare safety, effectiveness, and cost of the new oral Factor Xa inhibitor rivaroxaban to fondaparinux, an injectable anticoagulant, for prevention of venous thromboembolism (VTE) after hip or knee arthroplasty within an inpatient rehabilitation facility (IRF). Multiple reported studies have compared rivaroxaban with enoxaparin for thromboprophylaxis; however, there are no studies reported comparing safety, effectiveness and cost of rivaroxaban versus fondaparinux. Anticoagulants commonly used for thromboprophylaxis require parenteral administration or require dose monitoring due to unpredictable pharmacodynamic properties. Rivaroxaban is the first available orally active anticoagulant that does not require dose monitoring.

Methods: The institutional review board approved this retrospective cohort study at a 128 bed free-standing inpatient rehabilitation facility (IRF). Data was collected on the patient sample of convenience who were either status post total knee arthroplasty or total hip arthroplasty, admitted to the IRF over a 24 month period (January 2011 to December 2012). All identified patients received either fondaparinux 2.5 mg subcutaneously (primary agent until October 2011) or rivaroxaban 10 mg orally (primary agent since November 2011) once daily as the primary anticoagulant agent for VTE prevention. Primary effectiveness outcomes were composite of any deep venous thrombosis (DVT), proximal and/or distal; non-fatal, symptomatic, objectively confirmed pulmonary embolism (PE); and all-cause mortality. Primary safety outcomes were any major or non-major bleeding events. Major bleeding event was defined as bleeding into critical organ, clinically overt bleeding leading to fall in hemoglobin of greater than or equal to 2g/dL or leading to transfusion of 2 or more units of blood. Minor bleeding events were defined as epistaxis, gingival bleed, hematochezia, hematuria, or clinically symptomatic anemia requiring anticoagulant to be discontinued. Cost comparison was done by calculating cost of total doses of rivaroxaban dispensed and the cost of equal number of fondaparinux doses.

Results: Analysis of 314 patient records (199 patients on rivaroxaban and 115 patients on fondaparinux) indicated no PE events during their IRF stay. No VTE occurred in the patients prescribed rivaroxaban compared to 0.87% in fondaparinux group. Major bleeding events occurred in 0.5% of patients prescribed rivaroxaban compared to 1.74% in fondaparinux group.

Minor bleeding events occurred in 1% of patients prescribed rivaroxaban compared to 1.74% of patients in fondaparinux group. Direct acquisition cost analysis revealed savings of approximately \$13,000 (52% lower costs than fondaparinux) in the patients treated with rivaroxaban. Event related costs were not analyzed. Of the major bleeding event identified in rivaroxaban group, the patient required 2 units of blood transfusion due to drop in hemoglobin but was restarted on rivaroxaban without further adverse event. Of the two major bleeding events identified with patients prescribed fondaparinux, both required blood transfusions and the drug was discontinued. Of the minor bleedings events identified with patients prescribed rivaroxaban, anti-coagulant was discontinued due to hemoglobin being low in one case and continued in the other. Of the minor bleeding events identified with patients prescribed fondaparinux, anti-coagulant was discontinued in one due to symptomatic anemia and continued in the other.

Conclusion: In this study, rivaroxaban provided a safe and effective alternative to fondaparinux for prevention of VTE in post-operative total hip or knee replacement patients in the IRF setting. Rivaroxaban was also found to be favorable with respect to cost of acquisition, and ease of drug administration.

Category: Cardiology / Anticoagulation

Title: Impact of the clinical pharmacist counseling on patient's warfarin knowledge

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Purpose: Clinical pharmacists play an integral role in achieving treatment goals, and improving therapeutic outcomes through the effective patient counseling and education. Warfarin, a highly efficacious oral anticoagulant, is associated with serious interactions and adverse events that hinder patient treatment. Patient education about major areas regarding warfarin dose, side effects, and toxicity is clearly identified as a cornerstone of achieving improved health and quality of life. Clinical pharmacists are the key elements known to contribute to effective patients guidance and education. The purpose of this study is to alleviate Lebanese patients total warfarin awareness before and after the clinical pharmacist counseling.

Methods: This was a prospective, interventional, multicenter study conducted from February till May 2013. Patients above eighteen years old on warfarin in both community and hospital settings in Lebanon were eligible for study enrollment. Excluded were the patients with cognitive or psychiatric disorders. Baseline warfarin knowledge is assessed according to a questionnaire filled by the clinical pharmacist. Individual verbal and written counseling were provided to each participant about warfarin in terms of dose, side effects, drug-drug interaction, food-drug interaction, monitoring, diet, and quality of life. The same questions were asked after counseling to all participants to assess the impact of the clinical pharmacist intervention on improving patients education. 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: A total of 130 patients were enrolled in this study with baseline age of 61.62 +/- 15.392 years (mean +/- standard deviation SD), and body mass index 28.62 +/- 5.458 Kg/m². From the participants, 43 (33%) had venous thromboembolism (VTE), 65 (50%) atrial fibrillation (a-fib), 19 (14.6%) valve disease or replacement, 6 (4.6%) stroke, and 2 (1.5%) systolic left ventricular dysfunction. The total warfarin knowledge score after counseling is 9.046 times higher than the score before counseling (p-value <0.0001). Similarly, drug dose, drug toxicity, drug-drug/food-drug interactions and INR knowledge scores after counseling are respectively, 0.946, 1.592, 1.985 and 2.154 times higher than the scores before counseling (p-value <0.0001).

Conclusion: This study demonstrates that the clinical pharmacist counseling is successful in improving patients knowledge about the factors that affect warfarin therapeutic outcomes. A

positive impact of the pharmacist on achieving the goals is evident among all enrolled patients. Thus, pharmacists tasks are not only limited to the practice of medication dispensing but includes various responsibilities as enhancing patient awareness about the disease and drugs and enhancing monitoring of disease progression.

Category: Cardiology / Anticoagulation

Title: Impact of the clinical pharmacist counseling on patient's therapeutic INR levels

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Purpose: Achievement of a therapeutic International Normalized Ratio (INR) range after warfarin therapy initiation is the cornerstone of successful future control throughout the patients therapy. As part of effective anticoagulation management, frequent INR monitoring, dose alteration, and patients education are therefore necessary. This is established by the clinical pharmacist contribution to achieve excellent therapeutic outcomes. The purpose of this study is to evaluate the role of the clinical pharmacist on achieving the therapeutic INR among Lebanese patients.

Methods: This was a prospective, interventional, multicenter study conducted from February till May 2013. Patients above eighteen years old on warfarin in both community and hospital settings in Lebanon were eligible for study enrollment. Excluded were patients with cognitive or psychiatric disorders. Baseline INR level was assessed by the clinical pharmacist. Individual verbal and written counseling were provided to each participant about warfarin in terms of dose, side effects, drug-drug interaction, food-drug interaction, monitoring, diet, and quality of life. A second INR level recording was scheduled one month after the first reading to assess the impact of the clinical pharmacist intervention on improving patients therapeutic INR levels. 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: A total of 130 patients were enrolled in this study with baseline age of 61.62 ± 15.392 years (mean \pm standard deviation SD), and body mass index 28.62 ± 5.458 Kg/m². From the participants, 43 (33%) had venous thromboembolism (VTE), 65 (50%) atrial fibrillation (a-fib), 19 (14.6%) valve disease or replacement, 6 (4.6%) stroke, and 2 (1.5%) systolic left ventricular dysfunction. From the total enrolled patients, 38.5% had therapeutic INR before counseling and 73.1% after counseling with a mean score of 2.05 ± 0.774 and 2.44 ± 0.450 respectively with a p-value <0.0001 .

Conclusion: Based upon the above findings, the clinical pharmacist plays an important integral role in preventing treatment failure through continuous education and proper communication with patients. Pharmacists can minimize medication errors by optimizing the appropriate use of

drug dose, duration and encouraging routine monitoring. This allows for an effective change to enhance treatment benefits, improve quality of care and ensure maximum patient safety.

5-024

Category: Cardiology / Anticoagulation

Title: Pharmacist-run anticoagulation management service improves time-in-therapeutic range, reduces adverse outcomes associated with anticoagulation, and improves patient and physician satisfaction

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Purpose: The Hallmark Health System Anticoagulation Management Service is an outpatient clinic specializing in the care and management of patients on warfarin and other anticoagulant medications. Quality metrics used to measure appropriate anticoagulation management such as time in therapeutic range (TTR) and number of emergency room visits due to anticoagulation-related events have been reported in the literature to improve when patients are managed by a pharmacist-run centralized anticoagulation service. Improvements in both these metrics have been demonstrated at our own institution since the opening of our clinic.

Methods: Improvements in time in therapeutic range (TTR) has been accomplished through a 3-tier approach: Technology, Education, and Availability (TEA). T Technology: Use of a specialized anticoagulation management software system provides a dosing support tool, drug interaction check, scheduling system to track patient testing compliance, lab interface with immediate access to INR results, and interface with our electronic medical record to facilitate communication with other providers. E Education: A comprehensive phone intake is conducted with each patient prior to enrollment. Patients receive education on their indication for anticoagulation, INR range, compliance with therapy, and other important aspects of their anticoagulation therapy including diet, medication interactions, signs and symptoms of bleeding, options for INR testing and importance of compliance with testing. A warfarin educational booklet is mailed to each patient after the initial intake to supplement the education they receive during the phone intake. A AVAILABLE: Direct access of a specialized anticoagulation care provider to the patient is one of the advantages afforded to our AMS patients, facilitating communication between clinicians and patients that allow us to identify factors that may affect anticoagulation therapy.

Results: Improvement in TTR from baseline of 55% to 69% (Average TTR reported in literature as a measure of appropriate anticoagulation management ~64-68%) was measured using TTR calculator in anticoagulation management software. ED admissions due to anticoagulation-related adverse event was reduced by 21% and was measured by using relevant ICD-9 codes associated with clotting or bleeding to identify patients presenting to the ED for an anticoagulation-related event. Pending receipt of physician and patient satisfaction surveys.

Conclusion: Implementation of pharmacist-run anticoagulation management service has demonstrated improvements in quality indicators such as TTR and ED admissions.

Category: Cardiology / Anticoagulation

Title: Development and Outcomes of a Collaborative Practice for Chronic Stable Angina

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Purpose: Chronic Stable Angina (CSA) continues to place a heavy burden on society with an incidence and prevalence that is predicted to increase. Clinical pharmacists have successfully instituted collaborative practices for the management of various conditions such as anticoagulation, diabetes, hypertension, and hyperlipidemia. With clinical trials favoring optimal medical management over interventional strategies as an accepted treatment option, CSA becomes an increasingly unique condition that pharmacists can play a major role in managing. We describe our experience with the design and implementation of a pharmacist managed collaborative practice for chronic stable angina within the Department of Veterans Affairs.

Methods: Improvements in angina symptoms as measured by the Seattle Angina Questionnaire (SAQ) and safety measures which include details of adverse drug reactions and interactions as well as discontinuation rates following the initiation of ranolazine within our clinics treatment algorithm were captured. Details regarding the role of the pharmacist and the treatment algorithm will also be provided as the focus of the report.

Results: We found that the addition of ranolazine to a pharmacist optimized medical regimen for CSA improved all dimensions of the SAQ scores compared to baseline. Pharmacists were also able to ensure that relevant electrolytes were replaced during our treatment period and minimized the number of clinically significant drug interactions.

Conclusion: When instituted into collaborative practices, CSA may be another condition that pharmacists can successfully manage. Since pharmacists are instrumental in managing other chronic disease states, the use of pharmacists in managing CSA may prove to be advantageous in terms of safety, efficacy and costs.

Category: Cardiology / Anticoagulation

Title: Quality improvement of inpatient anticoagulation management over 5 years at a tertiary medical center

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Purpose: In 2008, the Joint Commission released National Patient Safety Goal (NPSG) 3E (now NPSG 03.05.01) which resulted in a nationwide hospital focus on improving the safety of anticoagulation. In response to this goal, our medical center invested resources into the pharmacy department to improve our practices in order to improve patient care.

Methods: A pharmacist was hired as anticoagulation program director who led development of a new anticoagulation subcommittee of the pharmacy and therapeutics committee. This committee determined the actions needed and plans to comply with the NPSG. Actions immediately taken included: development of a consult based inpatient anticoagulation management service (AMS) run by pharmacists; development of educational programs/resources for patients, physicians, nurses, and pharmacists; development of policies needed to cover the new NPSG standards; selection of metrics to follow for quality improvement efforts; and development of appropriate documentation of anticoagulation management. Over time, the inpatient anticoagulation service expanded to managing heparin induced thrombocytopenia patients; implementation of standardized ordersets for the use of heparin, low molecular-weight heparin, and warfarin; and developing resources on dabigatran etexilate, rivaroxaban, and apixaban.

Results: Documented patient education rates for patients on warfarin went from 35% in June 2009, to 95% in March 2011 (goals met). In the 15 months prior to full implementation of the new program on January 1, 2009, the percentage of patients who received a dose of warfarin in the hospital and then subsequently had an INR greater than 5 was over 4% for 9 of the 15 months, and greater than 10% for 4 of the 15 months. After full implementation, the highest value for a month has been 2.6%. The consult based anticoagulation service has gone from managing 7% of warfarin patients in March 2009, to managing 87% of patients on warfarin in April 2013. The increased utilization by providers and the expanded services led to the addition of another anticoagulation pharmacist shift. Over 6000 patients have had their warfarin managed by pharmacists since inception of the service. The use of an orderset when using therapeutic enoxaparin and warfarin went from 19% and 14.4% in October 2011 (when they were launched), to 88% and 100%, respectively in April 2013. Our hospital was found fully compliant with the anticoagulation NPSG when surveyed by the Joint Commission.

Conclusion: Our quality improvement efforts for anticoagulation therapy appear to have been successful and have created new direct patient care roles for pharmacists. The services provided by the pharmacy department and overseen by the anticoagulation subcommittee continue to evolve with the new oral anticoagulants.

5-027

Category: Cardiology / Anticoagulation

Title: Project safe: improving the safety of novel anticoagulant use at a community hospital

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Purpose: Anticoagulants have been identified as high risk medications that pose serious threats to patient safety. This initiative was selected after local ORYX measures revealed 9% of patients on an anticoagulant receiving documented education and following the addition of three novel anticoagulants. Since patients initiated on novel anticoagulants are not followed by an anticoagulation clinic, our facility was concerned about the lack of formalized education available. The purpose of this study was to determine if pharmacy led education initiatives within the acute care and ambulatory care settings would increase the proper use of anticoagulants and increase compliance with national quality standards.

Methods: All patients admitted who receive an inpatient order or outpatient prescription for an oral anticoagulant is eligible to participate in this program. A protocol for dosing novel oral anticoagulants was developed and a dosing card was created for providers. While patients are admitted, a pharmacist proactively reviews the dosing of oral anticoagulants to ensure appropriate dose based on age, indication, and renal function. Additionally, a clinical pharmacy dosing service is available to providers. Admitted patients on oral anticoagulants are identified daily for patient education. The pharmacist provides important anticoagulant safety counseling points with the patient and caregiver, provides discharge counseling, and documents the education within the electronic medical record. In the ambulatory care setting, utilizing monthly claims data, a pharmacist identifies all patients receiving prescriptions for novel anticoagulants. The pharmacist then uses the electronic medical record to review the indication for use, dosage, and pertinent labs for each patient. If an incorrect dose or missing lab is discovered, the pharmacist contacts the provider. A new education service was initiated for patients placed on novel anticoagulants. Identified patients see the pharmacist for initial anticoagulant education. At this visit, the pharmacist reviews patient labs and ensures initial dosing is appropriate.

Results: Preliminary data suggest improved anticoagulant dosing and patient education in our facility. During the six month study period, 112 admitted patients received oral anticoagulants. Of these patients, 34% were dosed by a clinical pharmacist. Eight patients (7%) were identified as being dosed incorrectly. The dosage change recommendations made by the pharmacists were accepted by providers and the resulting changes may have prevented a bleed or thrombotic event. Education was provided to 80.3% of patients on oral anticoagulants that were admitted, a 71%

increase over baseline. Ambulatory care pharmacists reviewed dosing, indication and labs of the 111 patients identified as receiving oral anticoagulants to ensure dosing was appropriate. Prior to the start of the education initiative, dosing of dabigatran was appropriate for all prescriptions identified from September to December 2012, and 75% of rivaroxaban prescriptions were dosed appropriately. Dosing for dabigatran was again 100% compliant from January to April 2013, and dosing for rivaroxaban increased to 88% compliant. Use of dabigatran for FDA approved indications remained high in both the baseline and recent time periods at 92%. Use of rivaroxaban for FDA approved indications remained high for both timeframes examined.

Conclusion: The initial success of this pharmacy-led facility-wide effort to ensure safe use of oral anticoagulants facilitated the decision to adopt the program for continued use. Experience to date suggests that pharmacist-involvement leads to improved inpatient and outpatient anticoagulation education, improved novel anticoagulation dosing, and improved compliance with national quality standards.

5-028

Category: Cardiology / Anticoagulation

Title: Safety of enoxaparin dosing regimens after cardiac ablation procedures

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Purpose: Ablation of foci within the left atrium has been shown to resolve symptoms of atrial fibrillation and atrial flutter. However, no standard has been established for anticoagulation after the procedure. Enoxaparin has been well described in the literature as a means to provide anticoagulation after a cardiac ablation procedure. The only doses previously studied were 0.5 mg/kg and 1 mg/kg, both given twice daily. The primary objective of this study was to compare the incidence of major bleeding in patients who received enoxaparin doses between 0.5 mg/kg and 1 mg/kg with patients who received 0.5 mg/kg or 1 mg/kg.

Methods: This single-center, retrospective cohort study included subjects greater than 18 years of age who received an atrial fibrillation or atrial flutter ablation procedure and at least one documented dose of enoxaparin post-ablation. Subjects were identified with an institution-specific registry of all cardiac ablation procedures. All statistical analysis was performed using GraphPad Software (La Jolla, CA). Nominal, categorical and continuous variables were compared using the ANOVA test, Kruskal-Wallis test, chi-square test or the Fisher exact test, as appropriate. Statistical significance was set at $p < 0.05$. This research was approved by the Institutional Review Board at Georgia Regents Medical Center.

Results: There were 119 subjects who satisfied the inclusion and exclusion criteria. The incidence of major bleeding in each group was similar ($p = 0.92$): enoxaparin doses greater than or equal to 1 mg/kg (1/21 or 4.8%), enoxaparin doses between 0.5 mg/kg and 1 mg/kg (2/67 or 3%) and enoxaparin doses less than or equal to 0.5 mg/kg (1/31 or 3.2%). No subjects in any group experienced a documented ischemic stroke ($p = 1$). Only the incidence of heart failure ($p = 0.03$) was different between groups at baseline.

Conclusion: There may not be a difference in the incidence of major bleeding between enoxaparin dosage ranges. Intermediate dose enoxaparin (0.5 mg/kg to 1 mg/kg) may be safe to use after cardiac ablation procedures.

5-029

Category: Cardiology / Anticoagulation

Title: Time to effect of oral versus intravenous vitamin K in adult patients requiring warfarin reversal

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Purpose: To compare the time to decrease the international normalized ratio (INR) in patients who received PO versus IV vitamin K for warfarin reversal.

Methods: A retrospective analysis was performed for adult patients admitted between July 1, 2007 and June 30, 2011 who were treated with greater than or equal to 1 dose of PO or IV vitamin K for warfarin reversal. The primary outcome was the time required to achieve an INR less than 5. Secondary outcomes were the dose of vitamin K used and the percent of patients failing to achieve an INR less than 5. The institutional review board granted this retrospective analysis exempt status.

Results: Four-hundred and nine patients had a baseline INR greater than or equal to 5; 251 patients received PO, and 158 received IV vitamin K. The mean (SD) time to achieve an INR less than 5 was 25.47 (12.84) hours for PO and 15.23 (7.89) hours for IV vitamin K ($p<0.001$). Mean (SD) dose of vitamin K used to achieve an INR less than 5 was 7.1 mg (5.5) in the PO group and 7.3 mg (4.8) in the IV group ($p=0.64$). The number of patients failing to achieve an INR less than 5 was 12 (4.8%) for PO patients and 2 (1.3%) for IV patients ($p=0.090$).

Conclusion: Intravenous vitamin K should be considered in emergent situations and when a timely decrease in INR is indicated.

Category: Cardiology / Anticoagulation

Title: Colchicine versus amiodarone for the prevention of postoperative atrial fibrillation after cardiac surgery

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Purpose: Postoperative atrial fibrillation (POAF) is a frequent complication after most types of cardiac surgeries with a 15-50% incidence following open-heart surgery. Despite ACC/AHA/ESC-supported evidence for use of oral beta-blockers or amiodarone as prophylaxis, POAF continues to be a significant complication. Given the increasing body of evidence which suggests inflammation plays a role in POAF induction, the impact of colchicine has been investigated for its efficacy in preventing POAF after open-heart surgery. The primary objective of this study is to compare the rates of POAF after CABG, valve replacement, or both between patients on colchicine versus amiodarone for prophylaxis.

Methods: This IRB-approved study included 248 patients in a pre-post study design comparing a historical group of 124 patients on amiodarone for POAF prophylaxis to a prospective cohort of 124 patients receiving the colchicine protocol for POAF prophylaxis. Patients meeting inclusion criteria consisted of adult patients undergoing cardiac surgery for CABG, valve replacement, or both, without contraindications to the study drug, and in normal sinus rhythm at the time of administration. Treatment with colchicine began after surgery at a dose of 1.2mg twice daily on post-operative day (POD) zero followed by a maintenance dose of 0.6mg twice daily until discharge for patients greater than 70kg. Patients less than 70kg received half the dose. Patients in the amiodarone arm received 600mg the night before and morning of surgery, followed by 400mg post-operatively every 12 hours for 7 days. An evidence-based medicine nurse extracted matched controls for the amiodarone group by collecting data within the Society of Thoracic Surgeons Cardiac Surgery Database. A two-month pilot study was initially conducted to determine the effect size for sample size considerations. Statistical analysis was conducted using Chi-square, two-proportion Z-tests, or Fishers exact tests for nominal data and students t-tests for discrete and continuous data.

Results: The final analysis included 248 total patients (mean age, 67 years, standard deviation 11.3 years; 67.7% male) with similar baseline characteristics. There was no statistically significant reduction in POAF in the colchicine group compared to that in the amiodarone group (34.7% versus 36.3% respectively; p=0.791; relative risk reduction 4.7%; number needed to treat

62). Colchicine was associated with a shorter in-hospital stay from time of surgery to discharge (53.3 versus 64.3 days; $p=0.041$) and there was a significant number of dose-limiting side effects in the amiodarone group compared to that in the colchicine group (21.8% versus 0% respectively with bradycardia, $p<0.001$; and 8.8% versus 0% respectively with QTc prolongation, $p=0.001$). Similar incidences of gastrointestinal side effects were seen in both groups (8.8% in each arm). Although there were four cases of postoperative death in the amiodarone arm and no cases seen in the colchicine arm, this was not a statistically significant difference between both groups ($p=0.112$).

Conclusion: Colchicine appears to be a safe and efficacious alternative to amiodarone for preventing POAF after cardiac surgery with a potential to decrease length of stay and dose-limiting side effects. Study limitations include potential bias from lack of randomized assignment, variable effect size based on a limited pilot study, and lack of power for secondary outcomes. Amiodarone use is limited in post-operative bradycardia and hemodynamic instability, particularly in combination with beta-blockers which prolong AV nodal conduction. Colchicine, a drug without beta-adrenergic blocking activity, may be a safe and effective add-on to standard beta-blocker therapy for preventing POAF after cardiac surgery.

Category: Cardiology / Anticoagulation

Title: Antithrombotic drug treatment patterns and resource utilization among venous thromboembolism patients: findings from a multi-payer analysis

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Purpose: Patients with prior venous thromboembolism (VTE) are at high risk for recurrent episodes which can have a significant impact on healthcare resource utilization. Use of antithrombotic agents to prevent recurrent events is recommended in these patients. In this study we assess antithrombotic medication treatment patterns and resource utilization among patients with VTE across multiple payers.

Methods: Retrospective analyses were performed using a software tool that analyzes health plan claims to evaluate treatment patterns and resource utilization for various cardiovascular conditions. Five databases were analyzed: 1) IMS LifeLink (IMS), 7/2008-6/2010; 2) OptumInsight (Optum), 4/2010-3/2012; 3) MarketScan Commercial (MSComm), 7/2009-6/2011; 4) MarketScan Medicare Supplemental (MSMedicare), 7/2009-6/2011; and 5) a Medicaid database from a southern US state (Medicaid), 7/2008-6/2010. Patients were ≥ 18 years old with a primary diagnosis of VTE (i.e., deep vein thrombosis (DVT) or pulmonary embolism (PE)) associated with an inpatient and/or emergency room claim, had received an antithrombotic within 7 days before or 14 days after index, and had no diagnosis of atrial fibrillation during follow-up. Outcomes including antithrombotic treatment gaps, medication possession ratios (MPR) for 3 months after index event, length of stay (LOS) for index hospitalization, recurrent VTE hospitalizations, and frequency of all-cause hospitalizations and emergency room (ER) visits were assessed over one year period following index.

Results: Total samples (mean age in years) included 373 (54) DVT and 686 (57) PE patients from IMS, 160 (50) DVT and 345 (51) PE from Optum, 548 (49) DVT and 993 (49) PE from MSComm, 198 (77) DVT and 312 (75) PE from MSMedicare, and 146 (47) DVT and 103 (46) PE from Medicaid. Mean MPRs for antithrombotic drugs were similar across all patients from all databases (range: 0.75-0.80). Gaps in therapy (≥ 60 days) were common across all populations, with Medicaid patients having fewer gaps (59% DVT and 57% PE) than commercial and Medicare patients (74%-83% DVT and 73%-78% PE). Recurrent event rates among PE patients (12-32%) were higher than those for DVT patients (6-16%) across all payers. More PE patients were hospitalized for their index event than DVT patients (42-59% DVT and 69-80% PE) and had longer mean LOS (2.59-2.95 days DVT and 3.23-3.76 days PE). All-cause hospitalization in

the year following their VTE episode occurred in 23-67% DVT patients and 30-68% PE patients. ER visits were also common, occurring in 27-72% of DVT patients and 29-75% of PE patients. Medicaid had the highest proportions of patients with hospitalizations and ER visits.

Conclusion: VTE patients across multiple payers commonly experience gaps in antithrombotic therapy. Recurrent VTE events are relatively common in this population, and VTE patients frequently experience all-cause hospitalizations and ER visits. These findings may be of interest to clinicians and policymakers charged with improving adherence to guidelines and quality of care.

Category: Cardiology / Anticoagulation

Title: Efficacy of an amlodipine/olmesartan medoxomil-based titration regimen in male and female subjects with hypertension and type 2 diabetes mellitus

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Purpose: To report the results for a prespecified analysis from a study that evaluated the safety and efficacy of an amlodipine (AML)/olmesartan medoxomil (OM)-based titration regimen in male and female subjects with hypertension and type 2 diabetes mellitus (T2DM).

Methods: The study comprised 2-3 weeks placebo, 18 weeks active treatment, and 2 weeks follow-up. Subjects received AML 5 mg, then uptitrated at 3-week intervals to AML/OM 5/20, 5/40, 10/40 mg, AML/OM plus hydrochlorothiazide (HCTZ) 10/40 plus 12.5 mg and 10/40 plus 25 mg (if seated [Se] blood pressure [BP] greater than or equal to 120/70 mmHg). The primary endpoint was the change in mean 24-hour ambulatory systolic BP (SBP) from baseline to Week 12. Secondary endpoints included the change in mean 24-hour ambulatory diastolic BP (DBP) at Week 12, 24-hour mean ambulatory BP (ABP) target achievement, SeBP goal achievement and SeBP changes. This study was conducted in accordance with Institutional Review Boards committee regulations and the Declaration of Helsinki. All patients provided informed consent prior to study participation.

Results: Baseline SeBP: Males (n equals 122), 158.7/90.1 mmHg; females (n equals 85), 159.0/87.6 mmHg. ABP at baseline was 144.3/83.9 mmHg and 144.4/78.2 mmHg in males and females, respectively. Mean ABP reductions of 19.0/11.5 mmHg in males and 21.3/10.9 mmHg in females (both P less than 0.0001) were similar to the 19.9/11.2 mmHg reduction reported for the total cohort. Mean 24-hour ABP less than 130/80 mmHg was achieved by 68 percent of males, 74 percent of females, and 70 percent of subjects in the total cohort at Week 12. In males, the AML/OM plus or minus HCTZ regimen resulted in SeBP reductions from baseline ranging from 17.2/8.6 mmHg (AML/OM 5/20 mg titration dose; baseline SeBP 158.4/90.2 mmHg) to 27.1/13.5 mmHg (AML/OM 10/40 plus HCTZ 25 mg titration dose; baseline SeBP 158.6/89.0 mmHg) (last observation carried forward; P less than 0.0001 vs baseline for all). In females, the AML/OM plus or minus HCTZ regimen resulted in SeBP reductions from baseline ranging from 19.1/7.7 mmHg (AML/OM 5/20 mg titration dose; baseline SeBP 159.5/87.5 mmHg) to 29.7/14.1 mmHg (AML/OM 10/40 plus HCTZ 25 mg titration dose; baseline SeBP 163.6/91.2 mmHg) (last observation carried forward; P less than 0.0001 vs baseline for all). Drug-related treatment-emergent adverse events (DR-TEAEs) were experienced by 16 percent and 25 percent

of males and females, respectively, versus 19 percent for the total cohort. DR-TEAEs of interest in males/females: peripheral edema (4.1 percent/8.2 percent), dizziness (3.3 percent/2.4 percent), and hypotension (2.5 percent/1.2 percent) versus 5.8 percent, 2.9 percent, and 1.9 percent for the total cohort, respectively.

Conclusion: An AML/OM plus or minus HCTZ treatment regimen resulted in significant 24-hour ABP and SeBP reductions. Overall, females had a higher incidence of DR-TEAEs, including peripheral edema, than did males. The treatment regimen was well tolerated in males and females with both hypertension and T2DM.

Category: Cardiology / Anticoagulation

Title: Pharmacist interventions in a clinic for heart failure, left ventricular assist device, and heart transplant patients and impact on thirty day readmissions

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Purpose: Although many reports of pharmacist involvement in ambulatory clinics have been published, there are no reports of pharmacist interventions in a clinic that serves left ventricular assist device (LVAD) or heart transplant patients. At a large teaching hospital the Advanced Heart Failure, LVAD, and Heart Transplant team invited a clinical pharmacist to work with the team in their clinic one morning per week to help with medication management. The objective of this study was to document and analyze recommendations made by the pharmacist in the clinic and consider their potential impact on the thirty day readmission rate.

Methods: Records of pharmacist interventions in the clinic from June 2012 to February 2013 were reviewed and analyzed to determine number of patient encounters, number of interventions, patients per clinic, interventions per encounter, and types of interventions. Thirty day readmission rates for patients seen by the pharmacist and for all patients admitted to the Advanced Heart Failure, LVAD, and Transplant team were also reviewed.

Results: Over a total of 21 clinic sessions, the pharmacist had 124 encounters with patients and performed 215 interventions. The pharmacist saw a median of six patients per clinic and performed a median of two interventions per patient. About 70% of interventions performed were related to medication reconciliation, medication education, and discovery of nonadherence to medications. Other interventions included recommendations to start or stop medications, order laboratory tests for monitoring, or change the dose or frequency of a medication. The pharmacist also provided drug information to prescribers in the clinic. The thirty day readmission rate for the patients seen in clinic by the pharmacist was 23.6%. The thirty day readmission rate for all patients admitted to the Advanced Heart Failure, LVAD, and Transplant team in the same time period was 26%.

Conclusion: Pharmacist involvement in a clinic for patients with advanced heart failure, LVAD, or heart transplant was particularly beneficial for medication reconciliation, medication education, and discovery of nonadherence to medications. The thirty day readmission rate was lower for patients seen by the pharmacist in clinic than for all patients admitted to the Advanced Heart Failure, LVAD, and Transplant team.

5-034

Category: Cardiology / Anticoagulation

Title: Development and implementation of a management protocol for reversal of novel oral anticoagulants at a Veterans Affairs medical center

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Purpose: Novel anticoagulants such as dabigatran, rivaroxaban, and apixaban are now available and commonly used as alternative oral anticoagulant therapy to warfarin. Bleeding is a serious and potential adverse effect that is shared among anticoagulants. However, unlike warfarin, there is no specific antidote available at this time to reverse the anticoagulant effect of these novel agents. The purpose of this project was to develop and implement an institution policy to provide clinicians and staff with a protocol and guidance for management of bleeding in patients taking novel anticoagulants.

Methods: A group of clinical pharmacy specialists and an anticoagulation specialist physician was formed to review current literature and evidence for methods to manage bleeding and reverse the anticoagulant effect with the novel anticoagulants. A "Reversal of Oral Anticoagulants" policy containing protocols for management of bleeding with dabigatran and rivaroxaban was drafted by this group based on current available evidence. This protocol was submitted to chief of emergency medicine, hematology/oncology, and the medical center's National Patient Safety Goal 3e group for review and further input. A revised protocol was brought to the Pharmacy Nutrition Therapeutics (PNT) council for approval. Pharmacy procurement was contacted for procurement and cost analysis of recombinant activated factor VII and three factor prothrombin complex concentrate. The pharmacy database was updated to include information on recombinant activated factor VII and three factor prothrombin complex concentrate consistent with protocol recommendations. A flowchart was drafted to create an electronic order set for dabigatran and rivaroxaban within the computerized order entry system. A PowerPoint slide presentation was created along with a one page summary handout for education of providers and pharmacists.

Results: Individual protocols were created for dabigatran and rivaroxaban (protocol for apixaban not yet developed but will be completed in the future). Both protocols included recommendations for general resuscitation or supportive measures for the anticoagulated patient who present with bleeding. Additional options for management of dabigatran-associated major bleeding include activated charcoal and/or hemodialysis. For life-threatening bleeding in a dabigatran patient, recombinant activated factor VII or three factor prothrombin complex concentrate may be used. Activated charcoal administration may be used for management of rivaroxaban-associated major bleeding. For life-threatening bleeding in a rivaroxaban patient, three factor prothrombin

complex concentrate may be used. Future revision of the policy is anticipated with the recent release of four factor prothrombin complex concentrate in the United States.

Conclusion: The novel oral anticoagulants have the advantage over warfarin of standardized dosing, less drug-drug and drug-food interactions, and less frequent lab monitoring. However, one limitation to these agents is the lack of a specific antidote to reverse the anticoagulant effect. This may be potentially dangerous in situations where urgent reversal is necessary such as major bleeding. As a result, an institutional policy was developed and implemented to provide a protocol for management of patients taking novel anticoagulants with bleeding complications.

Category: Cardiology / Anticoagulation

Title: Blood pressure lowering efficacy of olmesartan medoxomil and losartan potassium in subjects with metabolic syndrome

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Purpose: Results from a predefined exploratory subgroup analysis of subjects with metabolic syndrome (MetS, 2009 Joint Interim Criteria) are reported from a prospective, randomized, double-blind, forced-titration study of olmesartan medoxomil (OM) vs losartan potassium (LOS) in subjects with hypertension.

Methods: Study included a 3-4 week placebo run-in and 8-week active treatment: Arm A: OM 20 mg Weeks 1-4, OM 40 mg Weeks 5-8; Arm B: Placebo Weeks 1-2, OM 20 mg Weeks 3-4, OM 40 mg Weeks 5-8; Arm C: LOS 50 mg Weeks 1-4, LOS 100 mg Weeks 5-8. Analyses focused on comparison of Arms A and B combined (OM) versus Arm C (LOS). Efficacy endpoints were mean change from baseline in seated diastolic blood pressure (SeDBP) at Week 8 (primary endpoint); seated systolic blood pressure (SeSBP) and SeDBP at Week 4, SeSBP at Week 8 (secondary endpoints); BP goal achievement and mean 24-hour ambulatory BP target of less than 130/80 mmHg at Weeks 4 and 8 (tertiary endpoints).

Results: A total of 941 subjects were randomized: mean (plus or minus SD) age, 51.9 plus or minus 9.7 years; male, 54.5 percent; Stage 2 hypertension, 70.6 percent. Forty percent (376/941) of subjects had MetS. OM therapy resulted in a significantly greater reduction in SeBP than LOS at Week 4 (LS mean change: OM 20 mg 13.1/9.3 mmHg versus LOS 50 mg 9.6/6.4 mmHg; LS mean treatment difference equals 3.5/2.8 mmHg, P equals 0.0160/0.0029) and Week 8 (LS mean change: OM 40 mg 13.4/9.7 mmHg versus LOS 100 mg 9.5/6.4 mmHg; LS mean treatment difference equals 3.9/3.3 mmHg, P equals 0.0100/0.0008) in subjects with MetS. LS mean treatment differences between OM and LOS were similar to those reported for the total cohort at Week 4 (SeBP: minus 3.6/minus 2.7 mmHg; P less than 0.0001/0.0001) and Week 8 (SeBP: minus 3.9/minus 2.5 mmHg; P equals 0.0001/less than 0.0001). OM also resulted in a significantly greater proportion of subjects achieving the SeBP goal of less than 140/90 mmHg at Week 4 (30.9 versus 16.2 percent, respectively; P less than 0.01 versus LOS, last observation carried forward [LOCF]), Week 8 (33.7 versus 18.7 percent, respectively; P less than 0.01 vs LOS [LOCF]), and overall (50.5 versus 31.8 percent, respectively; P less than 0.001 vs LOS [LOCF]). Mean 24-hour ambulatory BP target of less than 130/80 mmHg was achieved by 37.7 percent and 12.0 percent of OM and LOS subjects at Week 4 (P equals 0.04) and 37.8 percent and 17.0 percent at Week 8 (P equals NS), respectively. Similar results were observed in the total

cohort. Both OM and LOS were well tolerated. Treatment-emergent adverse events (TEAEs) occurred in 36.2 percent (68/188) and 35.7 percent (65/182) of subjects with MetS in the OM and LOS groups, respectively, versus 31.2 percent and 31.6 percent, respectively, in the total cohort. The majority of TEAEs were mild-to-moderate in severity. There were no drug-related serious AEs or deaths.

Conclusion: In subjects with MetS, OM therapy significantly reduced SeBP more than LOS and resulted in more subjects achieving ambulatory BP target and SeBP goal. BP reductions were similar to those reported for the total cohort. Overall, the incidence of TEAEs were similar in both treatment groups and the treatment regimen was well tolerated.

Category: Cardiology / Anticoagulation

Title: Efficacy of an amlodipine/olmesartan medoxomil-based regimen in type 2 diabetics with stage 1 or 2 hypertension

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Purpose: To report the results of a prespecified clinical analysis from an open-label study that evaluated the safety and efficacy of an amlodipine/olmesartan medoxomil (AML/OM)-based regimen in patients with type 2 diabetes mellitus (T2DM) and Stage 1 or 2 hypertension.

Methods: The study comprised 2-3 weeks placebo, 18 weeks active treatment, and 2 weeks follow-up. Patients received AML 5 mg, uptitrated at 3-week intervals to AML/OM 5/20, 5/40, 10/40 mg, AML/OM plus hydrochlorothiazide (HCTZ) 10/40 plus 12.5 mg, and 10/40 plus 25 mg (if seated [Se] blood pressure [BP] greater than or equal to 120/70 mmHg). Endpoints: change from baseline in mean 24-hour ambulatory systolic BP (SBP) (primary endpoint) and ambulatory diastolic BP (DBP) at Week 12, 24-hour mean ambulatory BP (ABP) target achievement, SeBP goal achievement and SeBP changes. This study was conducted in accordance with Institutional Review Boards committee regulations and the Declaration of Helsinki. All patients provided informed consent prior to study participation.

Results: Baseline SeBP: Patients with Stage 1 hypertension (n equals 115), 149.3/85.2 mmHg; patients with Stage 2 hypertension (n equals 92), 170.7/94.0 mmHg. ABP at baseline was 139.0/79.5 and 151.1/84.2 mmHg in patients with Stage 1 and 2 hypertension, respectively. Mean ABP reductions were 17.9/10.4 mmHg in Stage 1 and 22.7/12.4 mmHg in patients with Stage 2 hypertension (both P less than 0.0001), and 19.9/11.2 mmHg for the total cohort. Mean 24-hour ABP less than 130/80 mmHg was achieved by 82 percent of patients with Stage 1 hypertension (n equals 77/94), 55 percent of patients with Stage 2 hypertension (n equals 39/71), and 70.3 percent of subjects in the total cohort at Week 12. In patients with Stage 1 hypertension, the AML/OM plus or minus HCTZ regimen resulted in SeBP reductions from baseline ranging from 14.1/6.6 mmHg (AML/OM 5/20 mg titration dose; baseline SeBP 149.3/84.9 mmHg) to 20.3/10.5 mmHg (AML/OM 10/40 plus HCTZ 25 mg titration dose; baseline SeBP 150.0/85.5 mmHg) (last observation carried forward; P less than 0.0001 vs baseline for all). In patients with Stage 2 hypertension, the AML/OM plus or minus HCTZ regimen resulted in SeBP reductions from baseline ranging from 22.7/10.3 mmHg (AML/OM 5/20 mg titration dose; baseline SeBP 170.4/94.0 mmHg) to 35.2/16.7 mmHg (AML/OM 10/40 plus HCTZ 25 mg titration dose; baseline SeBP 169.9/93.7 mmHg) (last observation carried forward; P less than 0.0001 vs

baseline for all). Drug-related treatment-emergent adverse events (DR-TEAEs) were experienced by 17 percent and 23 percent of patients with Stage 1 and Stage 2 hypertension, respectively, versus 19.3 percent for the total cohort. DR-TEAEs of interest in Stage 1/Stage 2 subgroups were peripheral edema (5.2 percent/6.5 percent, respectively), headache (1.7 percent/1.1 percent), and hypotension (2.6 percent/1.1 percent) versus 5.8 percent, 1.4 percent, and 1.9 percent for the total cohort, respectively.

Conclusion: An AML/OM plus or minus HCTZ treatment regimen resulted in significant 24-hour ABP and SeBP reductions, and enabled the majority of patients with Stage 1 or 2 hypertension to achieve 24-hour BP control. Overall, the incidence of DR-TEAEs was comparable between patients with Stage 1 or 2 hypertension and the treatment regimen was well tolerated irrespective of hypertension stage in subjects with both hypertension and T2DM.

Category: Cardiology / Anticoagulation

Title: Evaluation of anticoagulation prophylaxis in patients hospitalized at a Lebanese medical center

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Purpose: Venous thromboembolism (VTE) including deep vein thrombosis (DVT) and pulmonary embolism (PE) is a major complication that is frequently encountered in medical and surgical practice. Appropriate use of prophylaxis against VTE in inpatients is crucial to reduce the risk of post thrombotic complications and fatal and nonfatal PE. High risk VTE patients should be considered for evidence based anticoagulation with low molecular weight heparin (LMWH), unfractionated heparin (UH), fondaparinux, or vitamin K antagonist, unless contraindicated. Evaluation of anticoagulation prophylaxis in patients hospitalized at a Lebanese medical center is the purpose of our study.

Methods: 122 patients (83 males and 39 females) were involved in the study during the year 2012. Their age varied from 17 to 90 years old (mean 46.8 +/- 19.8) from different hospital units. This hospital follows the Caprini model to assess the eligibility of inpatients for VTE prophylaxis. A data collection sheet was filled to check the appropriateness of the practice of VTE prophylaxis and its adherence to the established guidelines. The Caprini model involves a risk assessment score, whereby a number of risk factors were attributed to 1, 2, 3, and 5 points based on their severity. Treatment was given according to the total risk score. 47 (38.5%) patients were at low risk (score 0-1), 12 (9.8%) patients were at moderate risk (score 2), 19 (15.6%) patients were at high risk (score 3-4), and 44 (36.0%) patients were at a very high risk (score >5). No patients had any contraindications for pharmacologic prophylaxis against VTE.

Results: According to the Caprini model, moderate, high and very high risk patients with no contraindications are candidates for pharmacologic VTE prophylaxis. Enoxaparin was the LMWH of choice at this center. Patients with a total risk factor score of 0-1 have a <10% incidence of VTE and require early ambulation. A total risk factor score of 2 or 3-4 are attributed to 10-20% and 20-40% incidence of VTE respectively, and require a pharmacologic agent. A cumulative score ≥ 5 is associated with 40-80% incidence of VTE and 1-5% mortality, and needs a combination of drug therapy and non-pharmacologic measures. 10.6% of low risk, 33.3% of moderate risk, 47.4% of high risk, and 77.3% of very high risk patients received prophylaxis with Enoxaparin and/or intermittent pneumatic compression and elastic stockings. Thus, 42.6% of the total number received enoxaparin as compared to 57.4% who werent administered any drug therapy (Chi Square: $P < 0.001$). Concordance between Caprinis theory and practice

revealed that 28 (37.3%) eligible patients did not receive VTE prophylaxis and 5 (10.6%) non-eligible patients were on a VTE prophylaxis agent (Cohens Kappa = 0.48 +/- 0.07; $p < 0.001$; OR=14.1 [5-39.8]).

Conclusion: Based on the above findings, it has been concluded that drug prophylaxis has been omitted in one third of eligible patients, and around 10% of non-eligible patients received drug prophylaxis. Regardless of the presence of the Caprini risk assessment model at this medical center, errors are still encountered in the practice of VTE prophylaxis. According to Caprinis recommendation, a careful individual assessment of thrombosis risk must be done in every patient to minimize the morbidity and mortality of venous thromboembolic events. Medical doctors and pharmacists should be encouraged to follow appropriate guidelines to ensure adequate prophylaxis against VTE.

5-038

Category: Cardiology / Anticoagulation

Title: Rivaroxaban as bridge to warfarin in a patient on chronic warfarin for venous thromboembolic disease

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Purpose:

Methods:

Results:

Conclusion:

5-039

Category: Cardiology / Anticoagulation

Title: Measuring the impact of pharmacist-managed warfarin service in a community hospital

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Purpose: Warfarin is a vitamin K antagonist that works on vitamin K-dependent coagulation factors II, VII, IX, and X. Warfarin management can be challenging due to a variety of factors that can affect response including: genetic variations, diet, drug interactions, liver dysfunction, and co-morbid conditions. This variation makes it necessary to have a complete history and understanding of the patient for successful management. An in-patient pharmacy-managed warfarin service was implemented at Clara Maass Medical Center to manage patients on warfarin therapy. The purpose of this IRB approved study was to measure the outcomes of patients delegated to the pharmacy service.

Methods: Charts of 63 pharmacy-managed warfarin patients from January to December 2012 were reviewed (Cohort 1). Patients were evaluated for their age, average number of days of therapy, starting warfarin dose, percent of time in therapeutic range (INR 1.8-3.2), and percent of patients subtherapeutic (INR<1.8) stratified by length of warfarin therapy. Cohort 1 was compared to data collected on all hospitalized patients treated with warfarin but not managed by the pharmacy in the 4th quarter 2012 (Cohort 2). Primary endpoints were the percent of time in therapeutic range and percent of patients subtherapeutic by days of warfarin therapy. Secondary endpoints were warfarin starting doses and average number of days of therapy.

Results: The percent of time in the therapeutic range for cohort 1 was 53.1% compared to 49% in cohort 2. The percent of patients sub-therapeutic on days 4-10 of therapy was 9.7% for cohort 1 and 24% for cohort 2. The warfarin starting doses differed in a higher percentage of 7.5mg used in cohort 1 than cohort 2, 24% versus 12% respectively, and a higher percentage of 10mg used in cohort 2 than 1, 16% versus 6% respectively. The average number of days of therapy was 4.4 days for cohort 1 and 4.2 days for cohort 2. No adverse events were reported. Only 1 patient received vitamin K in cohort 1.

Conclusion: The pharmacy-managed anticoagulation service at Clara Maass Medical Center demonstrated positive outcomes with a greater percentage of patients in the therapeutic range and a lower percentage of subtherapeutic patients by days 4-10. Evaluation of the patients managed by pharmacy highlights the importance of the appropriate warfarin starting dose. The selection of an appropriate starting dose resulted in a greater percentage of patients in therapeutic range in a shorter amount of time.

5-040

Category: Cardiology / Anticoagulation

Title: Impact of a multi-disciplinary venous thromboembolism screening tool and physician order set in an acute care community hospital setting

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Purpose: Venous thromboembolism (VTE), consisting of deep vein thrombosis (DVT) and pulmonary embolism (PE), is a preventable disorder and significant healthcare risk that results in increased hospital costs and potential deaths. The majority of patients admitted to an acute care hospital have at least one risk factor for development of VTE. Many VTE events that occur during hospitalization can be prevented through appropriate and timely initiation of prophylactic therapy in patients identified to be at risk. The purpose of this IRB approved study was to evaluate the clinical impact of a thromboprophylaxis screening tool and order set in prevention of VTE.

Methods: A nursing assessment tool and physician order set were developed and approved in December 2012 through an interdisciplinary committee. A retrospective review of inpatients for 3 months prior to the implementation (admit date 09/01/2012 12/01/2013) of the VTE prevention screening was done (Cohort 1). Cohort 1 was compared to inpatients selected from 3 months post implementation (admit date 12/02/2013 - 03/01/2013) of the VTE prevention screening tool (Cohort 2). Patients were categorized as medical, general surgery, or orthopedic. The type of prophylaxis was then analyzed: chemical, mechanical, both, or none. Data was collected from Trendstar for all patients who were admitted between 09/01/2012 and 03/01/2013 without contraindications for prophylaxis. The primary endpoint was the incidence of developing VTE. The secondary endpoint was the rate of patients receiving chemical or mechanical prophylaxis or both.

Results: There was a decrease in the incidence of DVT between cohort 1 and cohort 2 after the implementation of the screening tool: 2% to 1.2% ($P=0.003$) respectively as well as a decrease in the incidence of PE: 0.8% to 0.6% ($P=0.26$) respectively. The decrease in incidence of DVT in medical patients was 1.8% for cohort 1 and 1.1% for cohort 2 ($P=0.02$). There was an increase in the rate of patients receiving prophylaxis: 42.7% to 43.3% ($P=0.60$) respectively, but was not statistically significant.

Conclusion: The thromboprophylaxis screening tool and physician order set caused a decrease in the incidence of VTE and an increase in the rate of prophylaxis. However, it was only statistically significant in the medical patient population. Further analysis needs to be conducted.

Category: Cardiology / Anticoagulation

Title: A prospective, randomized, controlled trial of a novel pre-discharge self-administration of medication program in hospitalized heart failure patients

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Purpose: Self-administration of medication (SAM) programs in hospital settings improve patient medication knowledge and adherence, however, the effect of these initiatives on clinical outcomes is unknown. Post-discharge outcomes after stabilizing acute decompensated heart failure (HF) remain dismal with 180-day morbidity and mortality rates approaching 50%. The purpose of our investigation was to evaluate the feasibility and effects of a SAM program, fortified with disease specific education, on post-discharge outcomes in HF patients compared to usual care (UC).

Methods: Adults admitted to an inpatient cardiology service with a primary diagnosis of HF or myocardial infarction with a depressed left ventricular ejection fraction with diabetes or HF symptoms were randomized to the SAM or UC group. The local Institutional Review Board approved this trial. The primary endpoint was a composite of all-cause hospitalizations, emergency department (ED) visits, worsening quality of life, and all-cause mortality at 90 days. Patients who were Non-English speaking, involved in other research studies, in cardiogenic shock, actively listed for heart transplantation, intubated within the previous 24 hours or with a life expectancy < 1 year were excluded. Those in the intervention group self-administered medications under the direct supervision of their nurse and received medication and HF self-care education by pharmacist(s) and/or nurse(s). Patients in the intervention group were also provided medication and HF-self care education enduring materials.

Results: Although the targeted sample size (n= 168) was not reached due to slower than anticipated enrollment, 31 patients were enrolled (82% men; mean age 54 years); 4 patients withdrew. Twelve patients in the intervention group and 15 receiving UC were included in the final analysis. Overall, medication adherence was > 85% for 20 of the 24 subjects who reported baseline medication use. Twelve patients (100%) in the intervention group and 13 (86.7%) in the UC group had New York Heart Association Class III/IV symptoms on presentation. No deaths occurred in the 22 patients with 90-day follow-up available. All-cause ED visits and hospitalizations were available for 10 of the eleven patients in the intervention group and seven of the nine subjects in the UC group at 90-days. Ten patients (90.9%) in the intervention group and seven subjects (77.8%) receiving UC were evaluated in the ED or hospitalized at least once

during the 90-day follow-up period. Ninety-day medication adherence data was available for ten in the intervention group and six randomized to UC. Adherence was > 85% for 80% in the intervention group and for 100% in the UC group. One subject in the intervention group could not provide their adherence rate.

Conclusion: The coupling of a structured SAM and education programs provide a unique method to involve patients in their own care during a hospital admission. The outcomes associated with this type of program need to be further evaluated, as a small sample size precluded our ability to assess efficacy. Institutions may consider investigating further this type of program to reduce readmission rates and other outcomes in high-risk patient populations. This type of program, if beneficial, could expand opportunities for interdisciplinary patient care for pharmacists and nurses.

5-042

Category: Cardiology / Anticoagulation

Title: Breakeven estimates of treating subjects with 4-factor prothrombin complex concentrate versus fresh frozen plasma for patients with major medical bleeds from warfarin

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Purpose: Health care providers have been treating subjects suffering medical bleeds from chronic warfarin therapy with standard-of-care plasma with or without vitamin K. Four-factor prothrombin complex concentrate (4F-PCC), newly approved by the FDA, offers a shorter time to international normalized ratio (INR) reduction and may offer a differentiated economic profile that would underlie budget impact modeling. A model was created to produce these estimates.

Methods: Observational data from subjects with warfarin-related major medical bleeds captured within a large database from US hospitals affiliated with Premier were used to build the model. Pharmacy and all other costs from the hospitals perspective were measured and analyzed per number of plasma units administered. Multivariate regression was used to adjust other significant covariates to demonstrate the significance of each additional plasma unit in predicting ICU admission risk, and pharmacy and non-pharmacy hospital costs. Frequencies of plasma use by units from both arms of the pivotal trial of 4F-PCC versus plasma were used to drive the plasma-outcomes model to differentiate the estimated outcomes and costs of using either 4F-PCC or standard-of-care plasma. In the pivotal trial (<http://clinicaltrials.gov/ct2/show/NCT00708435>), both plasma and 4F-PCC were given as single doses, determined by patient weight and baseline INR, on Study Day 1 and were used in addition to vitamin K. Patients were randomly assigned and stratified by site of bleeding. Use of additional blood products was left to clinical judgment and taken into account for the co-primary efficacy parameter of effective hemostasis as determined by a blinded independent board. Product use by investigators was open label.

Results: Subjects on 4F-PCC (N= 98) had median pre-infusion INR of 3.9 and those on plasma (n=104) had a median of 3.6; 1.2 (n=87) versus 2.4 (n=93) at 30 minutes after infusion start ($p<0.0001$) and 1.2 (n=92) versus 1.4 (n=97) ($p=0.0002$) at 12 hours; no significant differences thereafter. Effective hemostasis achievement did not significantly differ between the two treatment groups. Subjects randomized to plasma received in totality 3 or more units with 93.3% frequency, whereas 4F-PCC subjects received concomitant plasma with 11.2% frequency for 1 or more units. The regression-based plasma model (N=23,347) demonstrated significant ($p<0.001$) and progressive cost elevations (US\$2,013) in subjects receiving 2 or more units of plasma. The pharmacy cost/subject ranged from \$6,872 for those receiving 1 unit to \$9,338 with >5 units (all US\$2013). Non-pharmacy inpatient costs/subject ranged from \$32,868 for those

receiving 1 unit to \$43,459 with >5 units. Significant odds ratios for ICU admission for plasma use >1 unit ranged from 1.15 for those receiving 2 units to 2.85 for >5 units (all $p < 0.001$). The budget impact model estimated a breakeven cost/episode of \$4,367: pharmacy cost- \$894, non-pharmacy inpatient costs- \$3,473. Sensitivity analyses demonstrated a robust range of estimated cost savings.

Conclusion: The rapid reduction of INR with 4F-PCC and reduced need for plasma was estimated to produce an economic breakeven point of \$4,269 total inpatient costs per episode. Most of the savings could result from reducing need for ICU admission. The savings estimates were population based and may not apply at the level of individual patients.

Category: Clinical Service Management

Title: Impact of concomitant use of vancomycin and piperacillin-tazobactam on nephrotoxicity in adult inpatients in a community hospital

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Purpose: The inpatients in acute care facilities are commonly treated for various infections with several antibiotics including vancomycin and piperacillin-tazobactam (pip-tazo) as the initial empiric therapies. Vancomycin daily doses over 4 grams have been associated with nephrotoxicity. Recent literature has suggested a possible increase in acute renal injury with this combination. Therefore, the purpose of this study was to assess the impact of concomitant use of vancomycin with piperacillin-tazobactam on nephrotoxicity in adult inpatients in our 240-beds community hospital.

Methods: This retrospective chart review study consisted of 226 adult inpatients (129 females, mean age 60.6 years-range 18-99) with a baseline serum creatinine (SCr) of less than 1mg per deciliter (dL) who received at least 3 days of vancomycin and pip-tazo from November 2009 through February 2013. They were divided into five Groups-A-vancomycin only 45 patients, B-pip-tazo-traditional 30 minutes infusion only 46 patients, C-pip-tazo-extended 4 hours infusion only 45 patients, D-vancomycin with pip-tazo-traditional infusion 44 patients, and E-vancomycin with pip-tazo-extended infusion 46 patients. Groups A-C were included to compare with the combination therapy groups-D and E. Nephrotoxicity was defined as an increase in SCr level of at least 0.5mg per dL during therapy. Vancomycin and pip-tazo were dosed using standard protocols. The data collection included length of therapy, daily vancomycin and pip-tazo doses, and SCr levels. The use of other concomitant nephrotoxic medications and presence of comorbidities such as sepsis were reviewed to consider other possible causes for nephrotoxicity. Calculations of the mean, range, and percentages were performed using Microsoft Excel. Statistical significance between the five groups was performed using Fishers exact test with a P-value of less than 0.05 for significance. This study was exempt from Institutional Review Board approval.

Results: For Groups A-C, the mean lengths of therapy were 4.42-4.91 days (range 3-12 days); daily vancomycin dose in Group A 1.91g (range 0.83-3.63), daily pip-tazo doses in Groups B-C were 9.77-10.34g (range 3.75-14.4); maximum SCr was 0.81-0.96mg per dL (range 0.47-2.18). Nephrotoxicity was observed in none of the Group A patients, in 4.4 percent in Group B, and in

2.2 percent in Group C. For the patients in Groups D-E, the mean lengths of combined therapy were 5.57-5.59 days (range 3-12 days); vancomycin daily doses 1.98-2.07g (range 0.56-4), daily pip-tazo doses 10.75-11g (range 5.9-17); maximum SCr 0.95-1.2 (range 0.44-4.63)-significantly more than in Groups B-C. Nephrotoxicity was observed in 22.7 percent of Group D patients and in 19.6 percent in Group E. Four of 10 patients in Group D and 2 of 9 in Group E with observed nephrotoxicities had also other possible causes such as use of intravenous contrast dye or sepsis. None had aminoglycosides or continuous furosemide drips. The nephrotoxicity observed in either of the Groups D or E was statistically significant (P less than 0.05) versus Groups A-C. However, the nephrotoxicity was not statistically significant between Groups A, B, or C or between Groups D and E.

Conclusion: The use of vancomycin alone did not show any acute renal injury in this study. The incidence of nephrotoxicity was less with the use of pip-tazo as an extended infusion alone versus traditional infusion method, though not statistically significant. However, the use of vancomycin concomitantly with pip-tazo by either the extended or traditional infusion method was associated with a statistically significant nephrotoxicity. Further studies may be needed to extrapolate the results of this study to larger patient population.

Category: Clinical Service Management

Title: Impact of pharmacist consultation for basal-bolus insulin management in hospitalized nephrology patients

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Purpose: The preferred method for achieving and maintaining glucose control in non-ICU patients with diabetes or stress hyperglycemia is a scheduled subcutaneous insulin regimen consisting of basal, nutritional, and supplemental elements. Although glycemic targets have been defined by the American Diabetes Association (ADA), American Association of Clinical Endocrinologists (AACE) and the Endocrine Society, there is no consensus on the optimal approach to titrating insulin in order to achieve these glycemic goals. The primary objective of this study was to compare the achievement of glycemic control before and after the implementation of basal-bolus glycemic protocols with pharmacist consultation. The secondary objective was to define the incidence of hypoglycemia, severe hypoglycemia, and severe hyperglycemia.

Methods: The investigational review board approved this retrospective and prospective study of glycemic control in adult patients. Patients admitted to the nephrology floor beginning June 15 through October 15, 2012 were retrospectively reviewed. All patients who had an active order for both a long-acting and short-acting insulin for at least 48 hours were included in the retrospective analysis. Patients who were administered sliding scale insulin monotherapy were excluded. Prospectively, patients admitted to the nephrology floor from October 16, 2012 to February 28, 2013 who had an active order for a basal-bolus glycemic protocol for at least 48 hours were included in the analysis. Patients who received corticosteroids, total parenteral nutrition, enteral nutrition or insulin pumps were excluded from analysis in both groups. Collected data included average daily blood glucose within 24 hours, 48 hours, and 72 hours of insulin therapy and at discharge. Glycemic control was defined as a daily average blood glucose less than 180 mg/dL with no incidence of severe hypoglycemia. Additionally, any blood glucose meeting the definition of hypoglycemia (< 70 mg/dL), severe hypoglycemia (<40 mg/dL) or severe hyperglycemia (>300 mg/dL) was recorded.

Results: From June 15 to October 15, 2012, there were sixty-four patients who met inclusion and exclusion criteria for the retrospective analysis. Thirty-seven patients were randomly selected. From October 16, 2012 to February 28, 2013, there were thirty-seven patients who met inclusion and exclusion criteria for the prospective analysis. The percentage of patients meeting the definition of glycemic control at all three evaluated time points was greater in the prospective

group (62.2%, 64.5%, 59.5%) compared to the retrospective group (35.1%, 52%, 37.8%). In the prospective group, patients with blood glucose at admission of greater than 180 mg/dL, experienced a greater percent reduction in average blood glucose from admission to discharge compared to the retrospective group (-21.3% vs. -10.7%). The majority of blood glucose readings fell within the target range of 70-180 mg/dL for both groups (41.9% and 52.7%). The incidence of hypoglycemia was greater in the retrospective group at 2.2% compared to 1.4% in the prospective group. The incidence of severe hypoglycemia was comparable between the two groups at 0.2% in the retrospective and 0.3% in the prospective. The incidence of severe hyperglycemia was greater in the retrospective group at 19.6% of readings compared to 6.6% in the prospective group.

Conclusion: The implementation of basal-bolus glycemic protocols with pharmacy titration resulted in a greater percentage of patients achieving or maintaining glycemic control. Additionally, patients admitted with blood glucose greater than 180 mg/dL achieved a greater reduction in average blood glucose by discharge. The use of a glycemic protocol also resulted in a decreased overall incidence of hypoglycemia and hyperglycemia.

5-045

Category: Clinical Service Management

Title: Use of a self rating scale to measure antipsychotics side effects

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Purpose: The acknowledgement and assessment of antipsychotics side effects constitutes an important part of the clinical management of psychotic illness. Clinicians who are able to efficiently assess side effects should be able to reduce iatrogenic consequences of drugs for their patients while at the same time enhancing compliance to the medical treatment. The Glasgow antipsychotic side effect scale (GASS) is used to allow a timely, sensitive and reliable method of gathering information to the number and severity of side effects a patient suffers from. It allows a grading not only of the frequency of an experienced side effect but also a subjective judgment of the distress associated with a particular side effect. In this study we report the use of a self administered questionnaire for antipsychotic drugs' side effects in order to diminish patients' non compliance to drug treatment.

Methods: Patients were asked to complete a GASS questionnaire and again each week to assess test-retest reliability. Every 10 days, the clinical pharmacist quantified side effects, and every month he reported them to the physician in charge. When interference for dosage or drug change seemed to be needed, the physician decided the changes needed. The new scale, GASSS was scored 0, 1, 2, 3, with higher score reflecting more frequent experience of side effects. Total GASS scores were divided for categorical severity, 0-12= absent/mild, 13-26 = moderate side effects and 27-63= severe side effects. Statistical analyses were performed. Categorical differences were determined using Mann Whitney test, with significance set at $p < 0.05$.

Results: Ninety eight patients were recruited from the psychiatric department at Barzilai Medical Center. All patients included met the DSM-R American Psychiatric Association criteria for schizophrenia and were currently receiving drug treatment. All patients found the GASS scale was easy to complete. It has an appropriate re-test reliability and is a short, helpful and valid clinical tool. Following first GASS questionnaire scores, reports displayed 8 patients with severe side effects (54, SD=7.8), 64 patients with moderate side effects (18, SD=9.5), and 26 with mild side effects (11, SD 9.1). Six month later the analysis of GASS scores revealed a statistically significant difference ($p < 0.05$): no patients with severe side effects, 30 patients with moderate side effects (13.4, SD= 9.7) and 68 patients with mild/absent side effects (7.82, SD=6.2).

Conclusion: Even in the case of ADRs under surveillance, there is evidence of a concerning degree of under reporting. Therefore, a routine use of a measure designed to comprehensively

document ADRs to antipsychotics, including reactions of a severity that might necessitate clinical intervention represents a timely and necessary innovation.

5-046

Category: Clinical Service Management

Title: Implementation of a system wide antimicrobial stewardship program in 86 long-term acute care hospitals 2008-2011

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Purpose: A Health System of Long Term Acute Care Hospitals (LTAC) determined the development of an antimicrobial stewardship program (ASP) would be a goal for each of the hospitals in 2009. Based on the observed usage across the system and the significant portion of the medication budget antimicrobials represented, it was believed there could be both a patient care and a financial impact. Due to the longer length of stay and unique patient population, clinical leadership in the system felt there was a tremendous opportunity to improve the usage of antimicrobials by implementing a system wide pharmacy coordinated ASP.

Methods: The pharmacy leadership team in coordination with representatives from nursing and physician leaders developed a pharmacist driven antibiotic stewardship program focusing on de-escalation using four pillars policies. The program focused on appropriate stop dates, appropriate route, appropriate culturing, and mandatory infectious disease consults with particular antibiotics. The program was approved by the systems National Medical Advisory Board Infectious Disease Subcommittee. Following approval, the program was rolled out to the 86 facilities in February 2009 via conference calls, site visits, and a national conference. Pharmacy leadership and the National ID Program Director provided ongoing support with site visits and conference calls with local leadership and local physicians. A video series was developed for all pharmacists to increase their knowledge of antibiotics and infectious disease. A physician geared video was produced and shared with local medical executive committees discussing the importance of the ASP in the LTACH setting. As the program developed the pharmacy leadership team focused on struggling facilities with breakout sessions at the annual medical director conference and site visits to share best practices and assist with barrier resolution.

Results: The primary indicator chosen to measure antibiotic usage was cost per patient day. This allowed all 86 hospitals in multiple states to be compared without manual data collection at each site. The program has been successful at reducing the overall use of antibiotics and antifungals. From 2008 (the benchmark year) to the end of 2011 antibiotic usage was reduced 21 percent and antifungals were reduced by 35 percent. In addition to an overall reduction in usage there was a 39 percent decrease in C. difficile and an 8 percent decrease in MDROs over the three years of

the program. The Health System has also seen a 65 percent reduction in the number of Central Line Associated Blood Stream Infections (CLABSI) compared to the 2008 baseline.

Conclusion: The goal of attaining a measureable reduction in antimicrobial usage was achieved with the added benefits being a reduction in incidences of *C. difficile*, MDROs, and drug cost. Adoption occurred through 86 different medical staffs in 26 states with differences in practice patterns and varying levels of prior exposure to antimicrobial stewardship. Implementing a stewardship plan at a single hospital or a multi-hospital system in the same geographic location presents challenges, but does not compare to the enormity of this project. The support of both national system and local leadership was essential to the success of this pharmacy program.

5-047

Category: Clinical Service Management

Title: Impact of decentralized pharmacy practice model on quality reporting metrics: patient satisfaction

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Purpose: Pharmacists have an important roll beyond drug distributive services. Cognitive services, such as teaching, drug information, patient counseling, and input during rounding are also important functions of the hospital pharmacist. Getting more pharmacists to the units should improve the quality of patient care and related metrics such as patient contact and patient perceptions of care (HCAHPS). As a departmental initiative, pharmacists were asked to document their activities, and try to influence HCAHPS metrics related to medication, discharge, and pain. Our objective was to determine the impact of adding more unit-based pharmacists on hospital metrics and consumer indicators of patient satisfaction.

Methods: Over the past few years, the departmental goal was to expand the decentralized pharmacy practice model. Our hospital has been a practice site for 3 clinical pharmacy faculty, Critical Care, Internal Medicine and Psychiatry. As a departmental initiative, additional decentralized pharmacists were added including clinical specialists in the Emergency Department (ED), and Infectious Diseases (ID), and one unit-based pharmacist in the med/surg cardio-telemetry area. Among other responsibilities, pharmacists were asked to determine who was being discharged and speak to them about their medications, and then document their daily activities using an internet-based tool. Data were analyzed in 6-month intervals from January 2009 to December 2012. Documented pharmacist activities, included, but were not limited to: rounds attended and patient contact. Rounds attended and patient contact tallies were corrected per 1,000 patient days. HCAHPS always scores for Pain, Discharge, and Communication About Medications were also collected for the entire hospital during each time interval. HCAHPS and documentation were correlated to the number of unit-based pharmacists at the time. A correlation (r) of 0.8 or greater was considered strong, and 0.5 0.79 was considered moderate. Mean values prior to expansion (Baseline, 2009-2010) were compared with after expansion (Intervention, 2011-2012) using t-test.

Results: From 2010 our department increased the number of unit-based pharmacists from 4 to 7. Increasing decentralized pharmacists increased documentation of rounds attended (Baseline 508 vs. Intervention 810.75, $p=0.277$; $r=0.635$) and patient contact (Baseline 299 vs. Intervention 1399, $p=0.002$; $r=0.973$). There was a strong positive correlation with Patient Contact/1,000 patient days, (Baseline 6.22 vs. Intervention 30.25, $p=0.002$; $r = 0.975$) and Discharge HCAHPS (Baseline 75.75 vs. 80.53, $p<0.001$; $r = 0.896$). There was a moderate positive correlation with Rounds Attended/1,000 patient days (Baseline 10.57 vs. Intervention 17.49, $p=0.24$; $r = 0.669$),

Medication Side effects described (Baseline 45.25 vs. Intervention 50.68, $p < 0.001$; $r = 0.79$), Communication About Medications (Baseline 60 vs. Intervention 64.7, $p = 0.005$; $r = 0.699$), Pain (Baseline 69 vs. Intervention 73.58, $p < 0.001$; $r = 0.691$), Pain Staff did everything (Baseline 74.5 vs. Intervention 79.15, $p = 0.002$; $r = 0.663$), and Pain Well controlled (Baseline 63.5 vs. Intervention 67.96, $p = 0.007$; $r = 0.641$). There was a weak positive correlation for Medication Tell me what my medication is for (Baseline 74.5 vs. Intervention 78.7, $p = 0.05$; $r = 0.494$).

Conclusion: Expanding the number and type of pharmacists on the units increased patient contact and the hospital-wide always response to select domains of HCAHPS scores.

5-048

Category: Clinical Service Management

Title: Implementation of a pharmacist driven renal dose adjustment service in a community teaching hospital

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Purpose: The focus of this study was to evaluate a pharmacist-driven renal dosing service in a community teaching hospital.

Methods: In this prospective study at HMC from January to March 2013, Quadrameds Computerized-Patient Record system was utilized to generate clinical reports of patients on specific trigger medications. The trigger medications were cefazolin, ciprofloxacin, enoxaparin, famotidine, and metoclopramide, which were identified through daily clarifications made by the pharmacists. The patient population included those who were 18 years of age and older, admitted on the hospitalist service, or generated on the clinical report with at least one active trigger medication. Exclusion criteria were patients admitted to a non-hospitalist service, behavioral health, maternity, same day surgery, and pediatrics. The primary endpoint was the number of interventions based on medications that require renal dose adjustments. Secondary endpoints were other interventions based on non-renal recommendations and cost savings. The evaluated patients were generated through the clinical report system or admitted onto the hospitalist service. A data collection sheet was created in order to document patient information. A daily pharmacotherapy assessment was completed with all recommendations made directly to the prescribers.

Results: There were 50 patients included in the study with 7 patients assessed from the clinical report and 43 patients from the hospitalist service. There were a total of 35 interventions and all were accepted by the prescribers; of which 25 were renal dose adjustments and 10 were non-renal recommendations. There was a total cost savings of \$7347 based on the completed interventions. Cost savings analysis was based on Quantifi, a third party clinical documentation tool with predefined cost savings built into the program.

Conclusion: The study had determined that there is a role for a pharmacist providing renal dose adjustments of medications in renal dysfunction.

5-049

Category: Clinical Service Management

Title: Cost saving and patient care benefits achieved by implementing hospital approved antifungal prescribing guidelines at a community hospital

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Purpose: Echinocandin use was identified as a cost savings opportunity at the hospital by benchmarking software. This project was designed to evaluate current echinocandin prescribing patterns to determine if these agents were prescribed appropriately.

Methods: A retrospective review of patients receiving caspofungin over a two month time period was performed. Twenty-one percent of patients were inappropriately prescribed caspofungin to treat urinary tract infections caused by a candida species. This data was presented to the hospital's Antimicrobial Stewardship committee. The committee determined that the hospital could benefit from antifungal treatment guidelines for physicians. Physicians and pharmacists were educated on the hospital's approved guidelines. Order entry pharmacists were given the responsibility of calling physicians if caspofungin was ordered on patients who did not meet prescribing criteria.

Results: After the antifungal guidelines were approved, a review of caspofungin therapy over a two month time period was repeated. This review showed that no patients were prescribed caspofungin for a urinary tract infection. As appropriate use of echinocandins increased, the drug spend on echinocandins decreased by forty-two percent in one year saving over twenty-four thousand dollars for the hospital.

Conclusion: Hospital approved antifungal guidelines can increase appropriate use of echinocandins and decrease the cost of treating fungal infections. Physician and pharmacist education and collaboration was key in the success of this project.

5-050

Category: Clinical Service Management

Title: Improving the accuracy of vancomycin level obtainment

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Purpose: Vancomycin requires therapeutic drug monitoring to ensure efficacy and safety. Trough levels should be obtained 30 minutes prior to the 4th or 5th dose and are used to estimate target attainment of the desired area under the curve. At Carolinas Medical Center- NorthEast, it was determined that approximately 50% of all high vancomycin trough levels were drawn incorrectly. This leads to delays in obtaining accurate therapeutic drug levels and/or re-work for both the nurses and the pharmacists. Our purpose was to improve the accuracy of obtaining vancomycin levels in order to improve target attainment and eliminate waste.

Methods: Vancomycin levels were analyzed over the course of five months. On a daily basis, decentralized pharmacists tracked patients receiving vancomycin who had a vancomycin level ordered. Each level ordered had documented the patient, type of level ordered (trough verses random), time due, resulted level, interpretation if drawn correctly, and additional comments suggesting why level wasn't drawn appropriately as needed. The first month's information was obtained as baseline information. Education was provided to pharmacists and nurses regarding appropriate ordering and timing of vancomycin levels. At month two and three, an additional tool was introduced to task the ordered level to nursing as a reminder. At month four, the addition of the nursing task was evaluated and updated. At month five, the nursing task was enhanced by the addition of a line item on the Medication Administration Record (MAR) to alert the nurse of an ordered vancomycin level. Monthly data was reported to pharmacy and nursing managers, as well as front line staff in the departments of pharmacy and nursing to serve as education and quality improvement.

Results: During the five month period, approximately 1100 vancomycin levels were ordered. Baseline information gathered in the first month resulted in 20% of levels being drawn incorrectly. Of the 20% drawn incorrectly, over 50% of those were actually missed levels. Over the next four months, the number of incorrectly drawn levels was reduced from 20% to 17%. The percentage of missed levels was reduced from 66% to 8%.

Conclusion: Through the use of lean tools such as A3 problem solving and going to Gemba, our pharmacy team was able to improve the accuracy of vancomycin level obtainment by 15% and reduced missed levels by 88%. In turn, we demonstrated a 40% reduction in vancomycin levels greater than 30 mcg/ml in a 4 month period. Collaboration with nursing was a key factor in our success. This project demonstrates a multidisciplinary approach to improving patient care.

5-051

Category: Critical Care

Title: Impact on quality and cost savings with transition of ipratropium/albuterol inhaler to nebulizer in ventilated patients

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Purpose: Ipratropium/albuterol metered dose inhalers (MDI) are commonly used for ventilated patients with severe respiratory disease. Unfortunately, inhaler penetration to lung is associated with several problems, including administration technique by individual respiratory therapists, potential disruption of ventilator settings secondary to added pressure, potential contamination, high waste and inefficient use of respiratory therapist time. Standard nebulizers cannot be used for administration of ipratropium/albuterol because they add flow to the ventilator circuit and increase the risk of circuit contamination. Therapeutic outcome can be improved with the use of alternate effective nebulizer to enhance drug penetration to the lungs. We describe the impact on provider satisfaction and cost savings associated with the ipratropium/albuterol administration via use of a special nebulizer (Aerogen) designed specifically for ventilated patients. Our health system spends \$2.4 million annually for the MDI. We decided to conduct a pilot study to evaluate the effectiveness of the new nebulizer at one of our hospitals in Detroit.

Methods: The use of the nebulizer was reviewed with the clinicians, respiratory therapists and pharmacists and the group developed a protocol to administer ipratropium/albuterol via the special nebulizer.

Results: Respiratory therapists feedback on the use were positive because of efficient use of their time. In addition, use of the device did not add pressure to the ventilators. Wastage was eliminated because of the use of single unit dose per administration. Cost per patient with the use of unit dose solution came down to \$46 from \$191 with the use of the MDI. Our expected annual savings at the Detroit hospital is \$420,000. We expect to save between \$870,000 to \$1.7 million based on 50% to 100% systemwide conversion

Conclusion: we conclude that a multidisciplinary team initiated effective use of a special nebulizer can achieve significant cost savings, optimal use of resources and provider satisfaction.

5-052

Category: Critical Care

Title: Pharmacotherapy Considerations during an Extracorporeal Membrane Oxygenation Program Implementation at a Tertiary Academic Medical Center

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Purpose: Brigham and Womens Hospital implemented an Extracorporeal Membrane Oxygenation (EMCO) program to provide more therapeutic options for critically ill patients. The ECMO circuit impacts the pharmacokinetics and pharmacodynamics of commonly used medications and requires frequently monitored anticoagulation. The purpose of this analysis is to describe the steps involved in implementing an ECMO program with a focus on pharmacotherapy management.

Methods: In 2012, a multidisciplinary team was tasked with the development and implementation of an ECMO program. To create pharmacotherapeutic recommendations, we conducted PubMed searches, ASHP/ACCP/UHC list serve surveys, and consultations with current ECMO programs to determine current standards of practice. Results of these searches, surveys, and consultations were compiled. Taking into account the obtained information as well as standards of practice at our institution, pharmacotherapy considerations were vetted through the multidisciplinary committee to create guidelines. The guidelines were then approved by the Pharmacy and Therapeutics Committee.

Results: Guidelines were created for anticoagulation, pain, agitation, and delirium (PAD) management, and antimicrobial therapy in ECMO. Unfractionated heparin is the preferred agent for anticoagulation and is monitored by bedside Activated Clotting Times and titrated via a nomogram at least every 60 minutes. Direct thrombin inhibitors are reserved for patients with clinically suspected or diagnosed heparin-induced thrombocytopenia and thrombosis. PAD is managed within our current standards of care (i.e. boluses and continuous infusions of benzodiazepines and opioids, continuous infusion of dexmedetomidine, and antipsychotics). Propofol use was limited due to potential for interfering with the oxygenator. Although standard PAD regimens are employed, doses drastically exceeding those commonly seen in clinical practice were anticipated due to pharmacokinetic changes and high level of drug-circuit binding. Therapeutic drug monitoring of hydrophilic antimicrobials is highly recommended due to the increased volume of distribution and potential drug-circuit binding.

Conclusion: When implementing an ECMO program, it is important to address the many pharmacokinetic and pharmacodynamic changes seen with commonly used medications in the

critically ill. We instituted guidelines for anticoagulation, PAD management, and antimicrobial therapy to aid clinicians in the proper management of patients requiring ECMO therapy. Future efforts are underway to validate the guidelines and further study the impact of ECMO therapy on anticoagulation and PAD management.

5-053

Category: Critical Care

Title: Continuing stress ulcer prophylaxis at ICU discharge: is it worth stressing over?

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Purpose: Stress ulcer prophylaxis (SUP) is recommended in intensive care unit (ICU) patients with risk factors for stress ulcer-related bleeding. As patients are downgraded from the ICU, their risk factors for stress ulceration generally resolve and SUP should be discontinued. The practice of continuing SUP when it is no longer indicated has been observed at our institution. The primary objective of this study was to decrease the inappropriate use of SUP at ICU discharge utilizing pharmacy-assisted medication reconciliation (MR). The secondary objectives of this study included categorizing any additional therapeutic interventions made by the pharmacist and the associated cost-savings.

Methods: Inappropriate SUP at ICU discharge was evaluated in two groups of patients. Group 1 (G1) was evaluated retrospectively via chart review prior to implementation of pharmacy-assisted MR. Group 2 (G2) was evaluated prospectively during ICU rounds after the implementation of pharmacy-assisted MR. Inappropriate SUP was defined as continuing SUP without an indication or discontinuing SUP despite an indication for therapy. During pharmacy-assisted MR at ICU discharge, eligible patients were evaluated for risk factors for stress ulcer-related bleeding based on our institutions SUP algorithm and published guidelines. Accordingly, recommendations to discontinue or continue SUP were made. Data analysis was conducted using descriptive statistics and a Fishers Exact Test.

Results: G1 consisted of 50 patients (42% male, mean age 65.52 +/- 14.38 years), and G2 consisted of 50 patients (36% male, mean age 65.10 +/- 15.74 years). Overall, inappropriate SUP at ICU discharge occurred in 56% vs. 26% of patients in G1 and G2, respectively ($P = 0.0042$). Continuation of SUP without an indication occurred in 50% vs. 26% patients ($P = 0.023$) and discontinuation of SUP despite an indication for therapy occurred in 6% vs. 0% of patients ($P = 0.24$) in G1 and G2, respectively. During the medication reconciliation process and time spent in the ICU, a total of 206 additional interventions were made, conferring a length-of-stay adjusted cost savings of \$8,859.17.

Conclusion: This study demonstrates the positive impact of pharmacy-assisted MR on decreasing inappropriate SUP at ICU discharge. The decrease in inappropriate SUP was driven primarily by a reduction in inappropriate continuation of SUP as opposed to inappropriate discontinuation of SUP.

5-054

Category: Drug Information

Title: Evaluation of vancomycin dosing and monitoring in hemodialysis patients during hospitalization

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Purpose: Vancomycin is commonly used in hemodialysis patients due to its efficacy in treating MRSA infections and convenience of less frequent dosing; however, there is minimal evidence to support a consistent dosing strategy to achieve recommended trough concentrations of 15 to 20 mcg/mL. The study aim was to evaluate dosing and monitoring of vancomycin in patients with end-stage renal disease (ESRD) requiring hemodialysis to determine if a standardized regimen could be recommended.

Methods: The University of Tennessee Institutional Review Board approved this retrospective observational study. Adult ESRD patients requiring hemodialysis and receiving vancomycin during hospitalization who met inclusion criteria over a 2 year period were evaluated. The average vancomycin starting dose, subsequent doses, dosing interval, number of levels per drawn per treatment course, the percentage of levels less than 10 mcg/mL, 10 to 20 mcg/mL, 15 to 20 mcg/mL and greater than 20 mcg/mL, and the number of vancomycin levels drawn inappropriately in relation to dialysis (drawn during or within 3 hours after dialysis) were determined. Vancomycin doses likely to achieve an initial vancomycin level between the target trough range of 15 to 20 mcg/mL were further evaluated.

Results: A total of 136 patients met inclusion criteria: mean age 61 years (SD 13), 52 percent male, 82 percent African-American, median weight 80 kg (IQR 67 to 96) and median length of stay 8 days (IQR 5 to 14). The average vancomycin starting dose and first subsequent dose was 16.3 mg/kg (SD 4.1) and 11.9 mg/kg (SD 4.3), respectively. The median dosing interval was 1.88 days (range 1.16 to 2.60) and there was a median of 2 levels drawn per treatment course. Of the 295 levels evaluated, there were 8.8 percent less than 10 mcg/mL, 58.3 percent between 10 to 20 mcg/mL, 33.6 percent between 15 to 20 mcg/mL, and 32.9 percent greater than 20 mcg/mL. Of these, 45 (15.3 percent) were inappropriately drawn. For patients with an appropriately drawn initial vancomycin level of 15 to 20 mcg/mL, the average starting dose was 17.5 mg/kg versus 15.3 mg/kg in patients whose initial level was less than 15 mcg/mL (p equals 0.024). Administration of an initial dose of 20 mg/kg (range 18.5 to 21.5), a weight-based dose often recommended in practice, was not associated with an increased rate of initial levels in the 15 to 20 mcg/mL range (p equals 0.192).

Conclusion: A vancomycin starting dose of at least 17.5 mg/kg was more likely to achieve an initial vancomycin level in the target range of 15 to 20 mcg/mL as recommended by MRSA guidelines; however, further evaluation to determine reasons why higher weight-based dosing did not achieve target levels is warranted. There is also a need to educate practitioners on the appropriate time to draw vancomycin levels in relation to dialysis to avoid problems with misinterpretation due to rebound in concentrations following the procedure.

Category: Drug Information

Title: Multicenter evaluation of aminoglycoside susceptibility of gram-negative bacilli isolates among urban and rural inpatient facilities over a 10-year period

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Purpose: Antibigrams are used to guide empiric therapy decisions and are an essential element of antibiotic stewardship. It is important to identify changes in susceptibilities over time at inpatient facilities so that appropriate recommendations may be made to limit the development of antibiotic resistance. The purpose of this multicenter study was to examine susceptibility patterns of gram-negative bacilli (*Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*) to aminoglycoside antibiotics among patients at three hospitals in Alabama (a 402-bed urban hospital, a 290-bed urban hospital, and a 71-bed rural hospital) over a 10-year period.

Methods: In vitro susceptibility data of systemic isolates to aminoglycoside antibiotics from patients tested at the laboratories of three inpatient facilities were analyzed. Institution-specific antibiograms including all tested isolates were constructed annually for data collected from 2003-2012. Recommendations regarding antibiotic use were provided annually to each facility. The three most prevalent gram-negative systemic isolates among the three facilities (*E. coli*, *K. pneumoniae*, and *P. aeruginosa*) were chosen for further analysis. Rates of susceptibility of the three pathogens to gentamicin and tobramycin were extracted from each antibiogram and were compared to identify differences in susceptibility over the 10-year period, among the three institutions, and between the urban versus rural settings.

Results: A total of 30 antibiograms were constructed for the three institutions over a 10-year period. Overall 10-year patterns of susceptibility for *E. coli* and *K. pneumoniae* were similar for both aminoglycoside antibiotics studied. However, for *P. aeruginosa*, higher susceptibilities to tobramycin versus gentamicin were evident across all three facilities. For *E. coli*, trends in aminoglycoside susceptibility varied among the three facilities. Similar patterns of aminoglycoside susceptibility of both *K. pneumoniae* and *P. aeruginosa* were noted among the two urban hospitals, including a sharp decrease in susceptibilities of both pathogens during the 2006-2008 period. In contrast, the decrease in aminoglycoside susceptibility of *K. pneumoniae* and *P. aeruginosa* seen during 2006-2008 at the urban hospitals did not occur in the rural setting. At the rural hospital, the aminoglycoside susceptibility of *K. pneumoniae* remained relatively constant (range, 95-98% for gentamicin and 93-99% for tobramycin) over the 10-year study period, while the pattern of susceptibility of *P. aeruginosa* at the rural hospital over the 10-year period was more variable (range, 63-84% for gentamicin and 80-97% for tobramycin).

Conclusion: Variations in aminoglycoside susceptibilities of *E. coli*, *K. pneumoniae*, and *P. aeruginosa* were found across a 10-year period among three inpatient facilities. Aminoglycoside susceptibilities differed between hospital settings (i.e., urban versus rural), with the rural hospital maintaining more constant rates of susceptibility of *K. pneumoniae* and *P. aeruginosa* over the 10-year study period compared with the urban hospitals.

5-056

Category: Drug-Use Evaluation

Title: Satisfaction with Dry Eye Treatment among Sjogren's Syndrome Patients

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Purpose: Sjogren's syndrome is an autoimmune disorder classified as primary if diagnosed alone or secondary if in conjunction with other autoimmune disorders. Nearly 4 million Americans are affected and women are more afflicted than men. Dry eye, a prominent symptom, is typically more severe in Sjogren's syndrome than other forms of dry eye. However treatment protocols to manage Sjogren's syndrome associated dry eye are non-existent. The purpose of this cross-sectional study was to determine what treatments patients use for dry eye, how well dry eye was controlled, and the relationship between dry eye severity and perception of control.

Methods: A cross-sectional study consisting of 14 questions was created using freeonline surveys.com. After institutional review board approval from Samford University, a link to the survey was posted on the Sjogren's Syndrome Foundation Facebook homepage for five weeks. Demographic information including age, gender, race, primary/secondary disease, and family history of Sjogren's syndrome was assessed. Patients named drug products used to treat dry eye and the satisfaction with products. Survey respondents ranked how the control of dry eye symptoms from 1-5 at the present moment and in an ideal situation. Both partial and completed surveys were included in analysis. ANOVA analyses were conducted to find correlations with age at diagnosis, severity of dry eye with how well the patient felt controlled.

Results: There were 359 surveys received from patients in America, England, Canada, Australia, and others. Ninety-four percent of respondents were female, and 78% had primary Sjogren's syndrome. The mean age was 48 years and mean age at diagnosis was 44 years. One hundred and thirty-three (37.78%) and 154 (43.75%) had moderate and severe dry eye respectively based on how often the dry eye symptoms were present. About 60% of the patients used one or two products to treat dry eye. Cyclosporin ophthalmic solution was the most common prescription product used followed by hydroxychloroquine, then pilocarpine, loteprednol, hydroxypropyl cellulose, and lastly cevimeline. Artificial tear products were the most common over-the-counter medications used, followed by gel formulations and then ointments. Thirty-four percent of respondents admitted to using other advanced therapies to help control their dry eye. Only 7.6% of respondents ranked their dry eye as being well controlled. Patients with severe dry eye were more likely to feel that their symptoms were not well controlled versus patients with milder dry eye ($p < 0.001$).

Conclusion: A wide variety of medications are used to treat Sjogren's syndrome associated dry eye. Very few patients felt dry eye symptoms were well controlled, suggesting a need for more

effective therapies. Patients perceived dry eye control significantly influenced by severity of dry eye. Limitations included lack of assessment of alternative therapies used to treat dry eye. Additional studies with more patients are warranted to determine guidelines to better treat Sjogren's syndrome associated dry eye.

Category: Drug-Use Evaluation

Title: Audit of efficacy and safety of once daily liraglutide versus twice daily exenatide in type 2 diabetes patients in Qatar; Two years observational study

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Purpose: To compare the effect on glycaemic control (reduction in hemoglobin A1C) of two drugs (liraglutide and exenatide) when added to subject's ongoing oral anti-diabetic drug treatment of either metformin, sulphonylurea or a combination of both in subjects with type 2 diabetes

Methods: Assessment of all type 2 diabetes patients started to take liraglutide or exenatide beside their oral hypoglycemic drug (metformin, sulphonylurea or a combination of both) in the period between 1st of February 2010 till 30th of January 2012(using pharmacy database) and had selected all patients continued to take the studied drug for at least 6 months. After identifying those patients, the data collection form had been completed by the investigators and well trained pharmacy technician by the researchers (once in awhile investigators will check) and had been collected from: a) Patients medical file b) Patients electronic file (medical database E-viewer and pharmacy database) Data collection sheet filled from a and b at the medical record departement

Results: Over the study period, total of 212 patients were taking either Exanatide (114, 53.8%) or Liraglutide (98, 46.2%). Study demographics were majority female patients (154, 72.6%), their mean age was 53 years (SD 10.3, [21-81]), and the mean duration for their diabetes disease is 13.5 years (SD 7.6, [5-48]). There was insignificant difference in the HgA1c difference between the base line, after 6 months and after 12 months of therapy for both medications. Liraglutide users HgA1c baseline 9.1, after 6 months 8.8 and after 12 months 11, P value non significant. Exanatide users HgA1c baseline 9.2, after 6 months 9.2 and after 12 months 9.1, P value non significant. However, there was a reduction in their BMI over 1 year and was statistically significant. Liraglutide users BMI baseline 37.5, after 6 months 37 and after 12 months 35.9, P value=0.014. Exanatide users BMI baseline 39.5, after 6 months 38.8 and after 12 months 38.4, P value=0.039.

Conclusion: Reem Elajezi In subjects with type 2 diabetes, both once daily liraglutide and twice daily exenatide did not led to significant improvements in glycaemic control over 1 year period. However; BMI reduction was statistically significant in both agents at 6, 12 months compared 10:52 PM Reem Elajezi [r.elajezi@gmail.com] Actions To: MZAINAB MALIK JASSIM Saturday, June 15, 2013 10:52 PM In subjects with type 2 diabetes, both once daily liraglutide and twice daily exenatide did not led to significant improvements in glycaemic control

(HbA1c) over 1 year period. However, BMI reduction was statistically significant in both agents at 6, 12 months compared to baseline. Further studies are needed to assess and allow comparison of Glucagon-Like peptide (GLP-1) against agents especially when weight loss and risk of hypoglycemia are major considerations.

Category: Drug-Use Evaluation**Title:** Evaluation of intravenous acetaminophen use at a community hospital**Primary Author:** Melissa M Lagzdins, Hillcrest Hospital, a Cleveland Clinic Hospital, 6780 Mayfield Road, Mayfield Heights, OH, 44124; Email: lagzdim@ccf.org

Purpose: Acetaminophen is a non-opioid analgesic and antipyretic that has been used for decades via the oral and rectal routes. Ofirmev, an intravenous (IV) formulation of acetaminophen, was approved for the reduction of fever, management of mild to moderate pain, and moderate to severe pain with adjunctive opioid analgesics in adults and children > 2 years old. Pharmacokinetic studies demonstrated an increased area under the curve and shorter time to onset compared to other formulations. In clinical studies, Ofirmev was superior to placebo, but equivalent to oral and rectal acetaminophen and non-steroidal anti-inflammatory drugs (NSAID). There is a significant price differential between acetaminophen formulations. Ofirmev (\$13.68/dose) is 200 times more expensive than the oral formulation (\$0.08) and 20 times more expensive than rectal (\$0.66). The Cleveland Clinic Health System (CCHS) Formulary instituted restrictions on IV acetaminophen to ensure appropriate prescribing and control medication costs. The restrictions include: IV acetaminophen must be prescribed by a staff/attending Physician; must not be used as first-line therapy; and must have a specific indication for use (ex, patient cannot receive an NSAID due to risk of bleeding). A drug use evaluation was performed to review adherence to the restriction criteria at a community hospital in the Cleveland Clinic Health System.

Methods: A retrospective chart review was performed using the electronic medical record to evaluate IV acetaminophen orders from January 2012 through March 2013 at Hillcrest Hospital, a 500-bed tertiary care and community hospital in Cleveland, Ohio. Adult patients (> 18 years old) with an order for IV acetaminophen were included. Data collected included patient demographics, ordering prescriber level, previous analgesia medications, specific indication for use, enteral status, pharmacist verification and intervention documentation, and number of doses administered. Concomitant analgesia was also recorded. Orders were assessed to be either appropriate according to the restriction criteria or inappropriate.

Results: Sixty two orders for 58 patients were identified. Twenty four percent (15/62) of the orders had zero doses administered, but were still evaluated for appropriateness. Fifty six percent (35/62) of orders received one dose, 3% received two doses, 8% received three doses, and 8% received > four doses. Fifteen orders (24%) were considered appropriate according to the restriction criteria. Seventy six percent of the orders (47/62) were considered inappropriate and in violation of at least one restriction criteria. Eleven percent of the inappropriate orders (5/47) were prescribed by a non-attending level provider. Thirty seven of the inappropriate orders (79%) were ordered as first-line therapy. However, 20 of these orders (20/37) were ordered for fever (temperature > 38 Celsius) in patients with no enteral or rectal access. One order did not have a specific indication for use. Thirty eight percent (18/47) of the total inappropriate orders for IV acetaminophen were in patients with viable rectal access. Forty three percent of all orders

(27/62) had appropriate pharmacist intervention documentation. Thirty one orders (50%) had no concomitant analgesia ordered.

Conclusion: The majority of orders for IV acetaminophen from January 2012 through March 2013 (76%) did not meet restriction criteria. Most often, Ofirmev was used as first-line therapy. A large subset of the patients receiving IV acetaminophen as first-line therapy received it for the treatment of a fever. This could potentially lead to alteration of the restriction criteria to allow use of Ofirmev for the first-line treatment of a fever in a patient with no enteral or rectal access. Additionally, we identified significant room for improvement with pharmacist intervention documentation and enforcing of prescription by staff-level providers. A large number of the inappropriate orders for IV acetaminophen (18/47) could have potentially been converted to the rectal formulation. Concomitant analgesia with NSAIDs and opioids may also be viable options. The results of this drug use evaluation will be presented to the Hillcrest Hospital Pharmacy and Therapeutic Committee and to the Cleveland Clinic Health System Clinical Coordinators meeting for review. Future recommendations include a more aggressive IV to oral/rectal conversion policy and allowance of treatment for fever as an appropriate restriction criterion.

5-059

Category: Drug-Use Evaluation

Title: Appropriateness of zoledronic acid use

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Purpose: Zoledronic acid is a bisphosphonate marketed as both Zometa and Reclast. Zometa is indicated for use in bone metastasis of solid tumors, multiple myeloma, and hypercalcemia of malignancy. Reclast is used in the treatment of osteoporosis in men, the treatment and prevention of osteoporosis in postmenopausal women, treatment and prevention of glucocorticoid induced osteoporosis, and the treatment of Paget's disease. Due to budgetary constraints, these agents have been placed in a prior authorization program. The purpose of this study is to assess the use of both Zometa and Reclast within a county health system that serves primarily indigent patients.

Methods: Utilizing inpatient and outpatient data, a retrospective review of patient medical records was conducted assessing all prescriptions filled from July 2011 through July 2012. A utilization report was acquired from the information technology department in order to conduct this review. In this utilization report, the following information was included: demographics, ordering prescriber, NDC, order description, dose, and package cost. To receive Zometa, patients were required to meet one of the following criteria: the prescription was written by an oncology attending physician, the patient failed pamidronate in the inpatient setting, the patient was found to have hypercalcemia of malignancy with an albumin corrected serum calcium greater than 10.8 milligrams per deciliter, or castrate resistant metastasis cancer to bone. Criteria for Reclast use required that patients either failed two oral bisphosphonates or had a documented adverse reaction to oral agents. In the event, that a patient fails to meet criteria, the physician on call could also approve the use of these agents.

Results: One hundred and seventy two charts were reviewed. Approximately thirty percent (51/172) of the patient population were male. Forty one patients received Reclast while one hundred and thirty one patients received Zometa. Of the patients who received Reclast, twenty five did not meet criteria, nineteen of which had only tried one other bisphosphonate while the remaining six had not tried any other oral bisphosphonate and had no documented adverse event to oral bisphosphonates. Among the patients who were prescribed Zometa, twenty one were noncompliant to established criteria. Four patients on Zometa failed pamidronate in an outpatient setting, twelve were given Zometa due to bone metastasis that was not castrate resistant, and five patients were being treated for multiple myeloma. Our results also indicated that four patients received Zometa for osteoporosis.

Conclusion: From this study, we concluded that compliance to the established criteria for Zometa was eighty four percent whereas compliance to Reclast was thirty nine percent. We recommend that the prescribing criteria for Reclast be revisited and that prescribers be made aware of the financial impact associated with the criteria for use.

5-060

Category: Drug-Use Evaluation

Title: Intravenous immune globulin stewardship program at a tertiary academic medical center

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Purpose: Brigham and Womens Hospital (BWH) has an extensive institution-specific prescribing guideline outlining indications for the use of intravenous immune globulin (IVIG). In October 2010, a pharmacist-driven stewardship program was implemented to ensure continued adherence to the prescribing guideline, focusing on indications for IVIG use and dosing per ideal body weight (IBW). The primary objective is to describe the impact of an IVIG stewardship program on IVIG utilization at a tertiary academic medical center.

Methods: Investigational review board approval was obtained prior to the commencement of this analysis. IVIG utilization data was collected from January 2013 through May 2013. Data collected included indications for IVIG, total number of patients receiving IVIG, the appropriateness of orders based in indication and dosing adherence, orders discontinued due to guideline non-adherence, and the actual grams dispensed (gramsIBW) verses theoretical grams potentially dispensed based on actual body weight (gramsABW).

Results: A total of 131 patients were identified during the study timeframe. The top indications were: hypogammaglobulinemia in bone marrow transplantation and hematologic malignancy, acute solid organ rejection, and immune thrombocytopenic purpura with bleeding. Four patients (3%) received IVIG for an indication non-adherent with the IVIG prescribing guideline. Two patients (1.5%) received a different dose per the prescribed indication. Six orders (4.5%) for indications non-adherent to the guideline were discontinued. A total of 7,121 grams were dispensed (gramsIBW) compared to the potential 8,910 grams (gramsABW), resulting in an overall dose aversion of 1,789 grams.

Conclusion: An IVIG stewardship program including an institution-specific prescribing guideline and a pharmacist-driven stewardship program may ensure guideline compliance for appropriateness of indication and dose for IVIG at an academic medical center.

5-061

Category: Drug-Use Evaluation

Title: Evaluation of the use of buprenorphine/naloxone in a tertiary care institution

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Purpose: Burprenorphine/Naloxone is a partial opioid receptor agonist/antagonist that is used to treat pain and opioid dependence. It was noted recently that there had been an increase in use and questions regarding appropriate dosing of this agent. This medication use evaluation aims to assess the appropriate use of buprenorphine/naloxone in a tertiary care institution.

Methods: A retrospective patient chart review of all patients who have received buprenorphine/naloxone between January 2012 and April 2013 was conducted. The following information was collected: patient demographics (age and gender), reason for admission, indication, dosing (initial/home dose, dose adjustments and average daily dose), prescriber, when/where medication was started, concurrent opioids received, consults ordered (pain management or psychiatry) and adverse drug events. The protocol for this evaluation and all research involved have been approved by the Pharmacy and Therapeutics Committee. Because this is a quality assurance project, review by the institutional review board has been waived.

Results: A total of 26 patients were prescribed buprenorphine/naloxone for pain or opioid dependence during the study period. The patients mean age was 48 years old (range 22 87 years old) and 61.5% of the patients were male. Three patients (11.5%) were prescribed buprenorphine/naloxone for management of chronic non-cancer pain and 23 patients (88.5%) for management of opioid dependence. The mean total daily dose of the buprenorphine component ordered was 18mg (range 2-32mg). Psychiatry consults were conducted for three patients and pain management consults were conducted for six patients. Only one patient was started on buprenorphine in-house for opioid dependency and the remainder had been receiving it prior to admission. Thirteen (50%) patients received opioids during their admission. Three patients were receiving an opioid along with buprenorphine/naloxone prior to admission. Nine (35%) of these patients received opioids concurrently with buprenorphine/naloxone. No withdrawal symptoms were reported in any patients. Seven study patients were admitted for a surgical procedure and all of them received opioids post-operatively. Four of them had their buprenorphine/naloxone appropriately held prior to their surgery. No adverse drug events attributed to buprenorphine/naloxone were documented for any study patients.

Conclusion: Based on the above results, we have identified several areas for improvement regarding the use of buprenorphine/naloxone at our institution. Educational materials are being developed to help the pharmacists understand the proper dosing of this agent.

Category: Drug-Use Evaluation

Title: Top-down versus step-up therapy in moderate-to-severe crohns disease: a cost-effectiveness analysis from a third party payer perspective

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Purpose: Crohns Disease (CD) costs the United States healthcare system \$2 billion annually and the current standard of care relies on steroid centric step-up (SU) therapy. However, the use of steroids to induce remission has been associated with dependence, infections, and mortality, side effects minimized by newer and costlier anti-TNF α agents the use of which is being considered in top-down (TD) therapy. As a result, this analysis aimed to calculate the lifetime cost-effectiveness of both treatment strategies and to help determine which strategy should be endorsed in the treatment of steroid-naïve patients with moderate-to-severe CD from a third-party payer perspective.

Methods: A cost-effectiveness analysis (CEA) was performed utilizing Markov modeling to determine whether the TD approach fell within the willingness-to-pay threshold of \$50,000/QALY. The model included one SU arm and one TD arm with a cycle length of 1 year and a time horizon of 70 years. In the SU approach, a corticosteroid was used as first line induction therapy, followed by the use of infliximab and azathioprine (AZA) combination as second line treatment. In the TD approach, infliximab and AZA combination was used as first line induction therapy, followed by the use of adalimumab and AZA combination therapy as second line. Failure to respond to first line treatments could precipitate the need for surgery or second line treatments. CD related costs, including medications, appointments, hospitalizations, and surgeries, were incorporated along with efficacy data for each treatment option to obtain an ICER for the two approaches. Effectiveness was measured using the QALY.

Results: Our base-case analysis found the incremental cost-effectiveness ratio of the TD approach to be \$38,947, which was below the willingness-to-pay threshold of \$50,000/QALY. One-way sensitivity analyses indicated that the TD approach would be cost-effective as long as the cost of treatment exceeded \$22,296, and the cost of second line combination therapy (adalimumab plus AZA) did not exceed \$31,055. TD remained cost-effective as long as its utility was less than 0.769 QALYs. When the utility of the combination therapy with adalimumab plus AZA was lowered below 0.72, the SU approach became the more cost-effective option. The

probability of initiating a steroid after an exacerbation needed to exceed 0.853 for the TD approach to be cost-effective.

Conclusion: Although the base case analysis suggests the TD approach is cost-effective, the assumptions made during the analysis leave the results less robust. For costs, TD is optimal when first line therapy is branded, and second line is generic. For utilities, TD is cost-effective if the utility gained from second line is higher than that gained by first line agents. Thus, our TD base case assumptions potentially overestimated the utility of adalimumab plus AZA. Therefore, further research is needed to differentiate the utilities between different anti-TNF α agents, as well as the utility of initiating a second line biological after treatment failure.

Category: Drug-Use Evaluation

Title: Evaluation of current Greater Baltimore Medical Center (GBMC) vancomycin dosing nomogram's safety and effectiveness through retrospective patient data review

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Purpose: A new vancomycin dosing nomogram using the initial level after a loading dose as a guide for maintenance dosing was implemented at GBMC in order to standardize pharmacist dosing and help attain newly recommended vancomycin goal troughs of 15-20mg/ml. The purpose of this study was to determine if dosing according to the nomogram increased the risk of acute kidney injury (AKI) compared to patients dosed with deviations from the nomogram due to concern it was too aggressive. We also investigated factors thought to be related to increased risk of AKI to redesign the nomogram to reduce this risk.

Methods: The institutional review board approved this retrospective study including patients initiated on vancomycin pharmacy dosing between May 2011-June 2011 (post-implementation), and July 2011-present (period of suspected deviations from nomogram). Subjects included patients on vancomycin dosed by the pharmacy during study periods. Patients undergoing hemodialysis or dosed according to level due to unstable renal function were excluded. Data was collected by trained students and pharmacists from hard copy therapeutic drug monitoring forms and electronic medical records. Data points collected included age, gender, weight, height, BMI, medical conditions, indication, goal trough, initial dose, number of levels, days of therapy, length of stay, initial level, steady state level, serum creatinine, changes in serum creatinine, and concurrent nephrotoxic drugs. All data was entered into a standardized excel spread sheet for analysis. Statistics used include two tailed t-tests.

Results: Overall rates of AKI, defined as a serum creatinine increase by 0.3 within 48hrs during therapy, did not differ significantly between the cohort of patients dosed according to the nomogram (14.63%) and those dosed with varied adherence to nomogram (16.9%). Average steady state levels were significantly higher ($p=0.047$, $p=0.0006$) in both cohorts in patients with AKI than normal patients. Average length of stay (11.7 days vs. 6.99 days, $p = 0.0014$, and 8.35 days vs. 6.59 days, $p = 0.03$) and duration of treatment (6.63 days vs. 4.66 days, $p = 0.001$, 5.08 days vs. 4.3 days, $p = 0.02$) were longer in patients with AKI compared to normal patients. When stratified by BMI, average BMI was significantly higher ($p=0.04$) in the patients with AKI in the nomogram group, but not the varied adherence cohort. AKI was more likely in patients with a vancomycin level greater than or equal to 20mg/L in both cohorts ($p < 0.05$). Average initial level was significantly higher in patients with AKI in the varied adherence cohort but not the nomogram cohort (12.2mg/L vs. 10.6mg/L, $p = 0.03$).

Conclusion: The overall rates of AKI were not significantly different between patients dosed adhering to nomogram compared to varied adherence cohort. Factors found to be related to AKI include higher average steady state level, lower creatinine clearance, higher BMI, levels above 20mg/L, longer duration of therapy, and length of stay. Modification of the nomogram to aim for troughs of 10-17mg/L for most infections, maintaining levels below 20mg/L, dosing obese patients more conservatively, and limiting duration of therapy through the practice of antimicrobial stewardship may help mitigate the risk of AKI due to vancomycin.

Category: Drug-Use Evaluation

Title: Use of acute antipsychotic prescribing to identify delirium occurrence

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Purpose: Delirium is a common, morbid, and costly condition whose rapid identification is of interest to hospital systems and researchers. Identifying cases is difficult in the absence of prospective, standardized assessments and documentation within the medical record. The purpose of this study was to determine if acute antipsychotic prescribing was associated with clinical occurrence of delirium in a retrospective cohort for validation in a prospective cohort.

Methods: The retrospective cohort included veterans admitted to the VA Boston Healthcare System with a palliative care consult. Patients were excluded if they received antipsychotics or had evidence of mental status changes upon admission. Receipt of acute antipsychotic prescription was identified utilizing point-of-care medication administration records from admission to hospital-day 14. Clinical occurrence of delirium was determined utilizing a validated chart review instrument. The prospective cohort included veterans 65 years of age and older admitted to the VA Boston Healthcare Systems medical ward. Patients were excluded if they were admitted from a nursing home, rehabilitation center, intensive care unit, or other hospital; if they were expected to leave the hospital within 1 day; or if they had an impairment that would prevent them from completing the informed consent and cognitive screening tests. After obtainment of informed consent, patients were assessed for delirium daily by a clinical expert.

Results: Patients within the retrospective cohort were mostly male (97%) and of older age (mean age 74 13). Of 217 patients analyzed, 31% (n=67) developed delirium. Delirious and non-delirious patients did not differ significantly. Within the cohort, 18% (n=40) of patients were prescribed an antipsychotic during their admission, 31% (n=67) developed delirium, and use of antipsychotics indicated delirium with a sensitivity of 54% and specificity of 97%. Patients within the prospective validation cohort were also mostly male (94%) and of older age (mean age of 81 7). Of 100 patients analyzed, 23% (n=23) developed delirium. Acute antipsychotic prescribing indicated delirium with a sensitivity of 22% and specificity of 100% within this validation cohort.

Conclusion: In this retrospective study and prospective validation, we found acute antipsychotic prescribing to be very specific, but relatively insensitive to clinical occurrence of delirium. While

the method does not capture all delirious patients, those that receive acute antipsychotics are likely to be delirious. This method may be easily embedded into existing electronic systems within hospital settings. The utilization of this quick and inexpensive identification method may expand case identification for research and clinical interventions.

5-065

Category: Emergency Medicine / Emergency Room

Title: Implementation of pharmacist prospective review of non-emergent medications in the emergency department at a level 1 trauma center

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Purpose: Previous emergency department (ED) pharmacist studies have shown improved medication error rates with the incorporation of a pharmacist in the ED, but they do not always provide prospective medication order review. The purpose of this study is to evaluate the effectiveness following implementation of a limited prospective review of non-emergent medications in the ED.

Methods: Two ED pharmacists documented interventions for medications which required prospective evaluation prior to administration. This occurred after the conversion of the automated dispensing cabinets (Pyxis) to profile status. Orders were saved for evaluation from July 22, 2012 to January 31, 2013. Data collected included: baseline demographics, ED visit reason, medication, intervention type and outcome, and disposition of patient. The data was also evaluated for increased number of interventions and reduction of medication errors. This did not include medications that were dispensed from a centralized pharmacy which would always require prospective review.

Results: There were 58 interventions from July 2012 to January 2013. The median age was 37 (range 17 to 95), and the two most common ED visit reasons were acute injury and infectious etiology. 49 patients (84 percent) were discharged from the ED. The majority of interventions were for anti-infectives (47 percent), either from dose optimization or changing of anti-infective choice, followed by vaccines (33 percent). The most common medication error was an overdose of medication (n equals 33, 57 percent). 92 percent of the interventions were accepted without changes, and 6 percent of interventions were accepted with changes.

Conclusion: In addition to being a regulatory requirement in California, requiring non-emergent medications to be reviewed by a pharmacist prior to administration optimizes medication therapy and reduces the number of medication errors for both patients being admitted or discharged. Optimally, all medications should be reviewed by a pharmacist prior to administration; however, with limited resources, a prospective review of all anti-infectives, non-emergent and high risk medications would be beneficial and improve prescribing practices.

5-066

Category: Emergency Medicine / Emergency Room

Title: Adverse drug reactions related emergency department visits

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Purpose: Adverse drug reactions (ADRs), one of the major causes of hospital visits, increase morbidity and mortality. The patients with acute or severe symptoms have to visit emergency department (ED) for the immediate diagnosis and treatment. This study is aimed to identify the incidence of ADRs-related ED visits and the ADRs characteristics of its drug class. Also the preventive measures and strategies were designated for the ADRs minimization.

Methods: 196 medical records of ED patients admitted to the Samsung Medical Center (SMC) under disease category code Y40~Y59 were reviewed from Jul 2011 Jun 2012. The Y code refers to drugs, medications, and biological materials that causes adverse drug reactions during treatment. Among the 196 case-study records, 132 studies were selected. The cases not related to the result of ED visits were eliminated. The patient ages, ADR symptoms and severity of the causing drugs were analyzed retrospectively.

Results: 132 (0.19%) of total 71,099 ED visit patients were hospitalized for the ADR treatment. Adults aged 60 and above were found to be the majority (55.3%). The drug classes mostly related to ADR were: antineoplastic agents (39.4%), radiocontrasts (9.5%), antibiotics (8.0%) and the most common clinical features were: gastrointestinal (37.9%) and skin problems (25.8%). 92.4% of ADR symptoms appeared to be moderate to severe which led these patients to have post-treatment care. Hospitalization (89.4%) was highly frequent for the ADR care and 59.8% of these patients had stopped taking their medication.

Conclusion: In this study, antineoplastic agents and radiocontrasts showed as a major cause of ADRs despite the fact that these drug classes appear in lower rate according to other previous reports. We estimated that the primary reason of this discrepancy is the rise in the number patients receiving anticancer treatments and medical image diagnoses. Therefore, during anticancer or radiocontrast management, premedication is needed for the ADRs minimization. In particular, customized ADR evaluation systems for antineoplastic agents are recommended for close monitoring because the current system has several limitations in evaluating the ADRs of antineoplastic agents. Additionally, it is important to counsel the patients on the predicted side effects and countermeasures of ADRs.

5-067

Category: Emergency Medicine / Emergency Room

Title: Impact of the emergency department pharmacist on pneumonia core measures

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Purpose: With the advent of value based purchasing and the desire to improve patient care, hospitals have increased incentives to achieve full compliance with the Centers for Medicare and Medicaid Services (CMS) core measures. Atlanticare Regional Medical Center has not consistently achieved compliance. This initiative was instituted to establish a consistent means for identifying potential pneumonia fallouts and attaining full compliance with the core measures.

Methods: A pharmacist was decentralized to the emergency department for 54 hours per week, coinciding with the hours when most emergency department admissions take place. One of the responsibilities of the emergency department pharmacist was to ensure appropriate antibiotic selection in compliance with CMS core measures for all admitted patients with community acquired pneumonia. A report was created in order to identify all admitted patients with the diagnosis of pneumonia within the last 24 hours. The patients antibiotic therapy was reviewed and compared to the pneumonia antibiotic consensus recommendations. If an antibiotic regimen was deemed inappropriate, the emergency department pharmacist intervened to ensure compliance.

Results: Prior to the emergency room pharmacist monitoring for community acquired pneumonia admissions, Atlanticare Regional Medical Center has never achieved full compliance. Full compliance for Medicare and Medicaid Services core measures for pneumonia was achieved for 3 of the 4 quarters in 2012 as a result of the emergency room pharmacist surveillance.

Conclusion: The emergency department pharmacist had a positive impact on appropriate antibiotic selection and prescribing practices in regards to pneumonia core measures.

Category: Emergency Medicine / Emergency Room

Title: Evaluation of pharmacy services in a level one trauma emergency department (ED) of a community hospital through the use of an ED specific intervention database

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Purpose: The presence of a pharmacist in an ED continues to gain popularity across U.S. healthcare systems. The positive impact of ED pharmacist interventions on patient care has been displayed in the literature. Although pharmacy departments have begun to include ED pharmacists in their staffing model, there is a lack of data on what types of interventions that may be included in their workflow. This project was designed to reveal a mechanism by which interventions could be recorded and analyzed to determine the types and rates of occurrence of interventions performed at a Level One Trauma ED of a community hospital.

Methods: An intervention database was developed to record interventions performed by an ED pharmacist. The intervention entry form includes collection of the following data: the date of the intervention, the time of the intervention, location of the patient within the ED on whom the intervention affected, a broad category of the type of intervention (ex. Code response/attendance), the specific type of intervention/action classified within the broad category (ex. Code stroke response, Code blue response, etc.), and any additional comments if needed. The data collected includes the type and number of broad categories of the type of interventions performed, as well as the type and number of the specific types of interventions/actions performed between the dates of January 21, 2013 June 7, 2013.

Results: A total number of 866 intervention entries were recorded into the database. The largest number of the broad category interventions involved code response/attendance (n=369, 42.6%). This was followed by drug information interventions (n=129, 14.9%), pharmacy protocol/consult management while the patient was in the ED (n=116, 13%), interventions on admission orders of ED patients (n=90, 10.4%), medication preparation/assistance (n=44, 5.1%), home medication reconciliation and/or home medication history collection (n=42, 4.9%), interventions via prospective review of ED medication orders (n=36, 4.2%), initiation of needed pharmacologic therapy (n=17, 2%), interventions on patients discharged from the ED (n=13, 1.5%), and adverse drug event management interventions (n=10, 1.2%). This information helped identify where the highest need of an ED pharmacist lies in the care of ED patients over this time period, as well as their role in the assistance of both the ED and pharmacy staff. This information was used to identify interventions whose rates of occurrence can be improved upon and how the workflow and technology can be modified to assist in the improvement.

Conclusion: An ED intervention database is helpful in identifying and recording various types and rates of occurrence of interventions performed by an ED pharmacist. This database will assist in identifying the most common categories of interventions, assist in identifying areas of improvement, as well as potentially being used as an educational tool by sharing various experiences and interventions with other ED pharmacists or pharmacy departments interested in implementing an ED pharmacist into their staffing model.

Category: Emergency Medicine / Emergency Room

Title: Patients clinical profiles and differences in physician reported likelihood of nitrovasodilator use in acute heart failure

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Purpose: Nitrovasodilator (NV) use in acute heart failure (AHF) is highly variable, despite the high prevalence of AHF patients presenting with a systolic blood pressure (SBP) > 140mmHg. The objective of this study was to evaluate the likelihood of NV use in patients presenting with different clinical characteristics and explore differences in NV use across different specialties.

Methods: US physicians treating 5 AHF patients/month with NV were identified from a healthcare sample provider panel and recruited by phone to participate in an internet-based survey. Physicians answered general AHF management questions, focusing on NV use. Physicians were also asked to select specific NV form and to rate their likelihood of recommending NV using a five point scale ranging from "never" to "extremely likely" in three different patient profiles: Profile 1 - Female, aged 60 years with systolic blood pressure (SBP) of 165 mm Hg, acute pulmonary edema, and minimal peripheral edema. Patient has diastolic dysfunction and preserved systolic function. Patient has been experiencing these symptoms for approximately 24 hours. Profile 2 - Female, aged 60 years with SBP of 110 mm Hg, acute pulmonary edema, and minimal peripheral edema. Patient has diastolic dysfunction and preserved systolic function. Patient has been experiencing these symptoms for approximately 24 hours. Profile 3 - Male, aged 50 years with SBP of 110 mm Hg, leg edema and anasarca. Patient has experienced abnormal weight gain over the past few weeks. Patient began noticing these symptoms one week ago. Pairwise t-tests and column proportion z-tests were used for statistical comparisons.

Results: Of 6,836 invites, 1,504 responded (172 emergency physicians (EP), 163 cardiologists (CARD), 91 hospitalists (HOSP)). In Profile 1, 71.5% of EP reported they are "extremely likely" to recommend NV therapy while the numbers were significantly smaller for CARD (49.1%) and HOSP (53.8%)($p < 0.05$). EP were significantly more likely to recommend sublingual than CARD (46% vs. 13.4%) or HOSP (46% vs. 12.5%) while CARD were significantly more likely to use IV than EP (45.8% vs. 30.1%) ($p < 0.05$, all). In Profiles 2 and 3, likelihood of recommending NV was lower in general ("extremely likely": Profile 2: 48.3% (EP) vs. 19.6% (CARD) vs. 23.1% (HOSP); Profile 3: 33.7% (EP) vs. 15.3% (CARD) vs. 15.4% (HOSP))($p < 0.05$, all). In Profile 2, IV (30.0%) and sublingual (29.3%) were the most frequently recommended and EP were significantly more likely to use sublingual than CARD (37.1% vs.

22.5%) and HOSP (37.1% vs. 22.0%)($p < 0.05$, all). In Profile 3, topical was the most frequently recommended (33%). EP were significantly more likely to use sublingual than CARD (31.3% vs. 11.3%) and HOSP (31.3% vs. 4.5%) while CARD were more likely to use IV than EP (38.7% vs. 13.0%) and HOSP (38.7% vs. 13.6%)($p < 0.05$, all).

Conclusion: While the likelihood of NV use was high for patients with high blood pressure and acute symptoms, it was significantly lower for patients with lower blood pressure or patients with slowly developing symptoms. Likelihood of NV use and NV selection in management of AHF vary by specialty, indicating the need for a tailored approach to patient care and physician education and research.

5-070

Category: Emergency Medicine / Emergency Room

Title: Pharmacy Student Medication History Pilot Program in a Financially Troubled Community Hospital

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Purpose: Accurate medication reconciliation is a crucial first step in the hospital admission process. Medications that are incorrectly added or omitted have both clinical and financial implications and can cause adverse outcomes, including fatal consequences. The Westerly Hospital trialed the use of 6th year pharmacy students to assist the medication reconciliation process in the emergency department. The purpose of this project was to identify potential barriers to adequate medication reconciliation and to increase accuracy.

Methods: The pharmacy department trained 6th year pharmacy students on advanced pharmacy practice rotations and employed by the hospital to assist the emergency department in their medication reconciliation efforts. The emergency department was made aware of the service and given a pager number to alert them to admission candidates. The students also periodically visited the department to increase awareness of the services. The students documented interventions made into 5 distinct categories: new medications added and verified, medications missing, wrong medications added previously, incorrect medication dose/frequency, and medications added by free text (not linked to the computer system).

Results: Reviewing interventions made over a 90 eligible-day period (excluding holidays and weekends, when coverage was unavailable), medication reconciliation services were provided 454 times, or an average of 5 times per day. Over the 90 day period, pharmacy students made 3,551 changes, including adding 2,107 medications, removing 879 medications, and editing 565 medications. Initially, the service was primarily retrospective, checking lists that had been previously verified by nurses and fixing errors. As the service became more utilized, pharmacy students were called for almost all patients requiring medication reconciliation. The most common type of intervention was adding and verifying a new medication list, followed by free text medication corrections. Interventions such as incorrect medication dose or frequency, wrong medication(s) added, or medications missing decreased over time since the service became utilized early in each patient's emergency department admission. It is estimated that 43% of errors corrected by the pharmacy would have caused harm if they had reached the patient. In this 90 day period, potential harm was avoided in 198 patients.

Conclusion: Feedback from emergency department nurses and providers has been overwhelmingly positive. Initially, pharmacy students on APPE rotations provided coverage from 7:30 am -4:00 pm when available. Due to high demand from the emergency department staff, starting in April, coverage extended until 8:30 pm and has recently expanded until 11:00 pm. Overall, this new pharmacy service provides another safety net in the complex field of emergency department visits.

5-071

Category: Emergency Medicine / Emergency Room

Title: Introduction of an Emergency Department (ED) Pharmacist Program at a Community Hospital

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Purpose: In the U.S., 44,000-98,000 people die annually from medication errors. One in 50 hospitalized patients experience a preventable adverse event¹ and 3% of these events occur in the ED¹. The average cost associated with a single medication error is \$1,100-3,500 while drug-related morbidity and mortality has an annual cost of \$76.6 billion.² An adverse drug event nearly doubles the hospital length of stay and risk of death.³ For these reasons, the Hallmark Health System (HHS) Pharmacy Department chose to implement an ED Pharmacist program, at the Melrose-Wakefield campus.

Methods: A business plan for expansion of pharmacy services into the ED was accepted for the FY12 year. A dedicated pharmacist started in July of 2012. Using the Meditech system, the pharmacist documents and clinically evaluates the patients home medication list. This electronic list is then used by the admitting physician to create the inpatient orders. An intervention tracking software program is used to track and calculate savings for key pharmacy interventions. The position is staffed 40 hours per week (Mon thru Fri, 1030-1900: as this time period represents the highest volume admission time).

Results: From September-May 2013, the ED pharmacist logged 1,783 interventions with an estimated cost savings/avoidance of \$47,736 (annualized = \$63,648). In addition to clinical interventions such as antibiotic recommendations, drip titrations and drug allergy avoidance, the presence of an ED pharmacist has allowed the advent of pharmacist-driven medication histories. From September-May 2013, the percentage of medication histories that were completed, by the ED pharmacist, for medical-surgical admissions ranged from 27-51%, with an average of 36% per month. Compliance, by physicians, in using the electronic medication history taken by the pharmacist, to write their electronic inpatient orders rose from 41% to 62%, between July and September 2012. The director of pharmacy has also received numerous e-mails from staff nurses and hospitalists about the increase in quality of the documentation of patient home medications, as well as the increased support they feel, around medication management, because of the presence of a pharmacist in the ED.

Conclusion: The acuity and volume of patients, in the ED, makes it an environment more prone to medication errors. Challenges in the ED include: over-crowding, high-risk patients, high-risk medications, rotation of staff, poor patient history, increased number of medications available

and lack of pharmacist medication review.¹⁻² For these reasons, an ED pharmacist position was created, and this position has shown it can increase quality, decrease costs and increase nurse and physician satisfaction in a community hospital setting.

5-072

Category: Emergency Medicine / Emergency Room

Title: Implementation of an emergency medicine pharmacotherapy class for third year pharmacy students

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Purpose: Emergency medicine is an emerging field in hospital pharmacy involving a unique skill set and knowledge base not fully addressed in conventional pharmacy classes. Standard 10.2 of the Accreditation Council for Pharmacy Education (ACPE) requires the availability of sufficient elective courses and pharmacy practice experiences to allow students to pursue special interests. To meet the educational needs of the emerging specialty and provide students with an increased selection of elective courses, an elective in Emergency Medicine Pharmacotherapy was designed.

Methods: The two semester hour course was offered annually and used a discussion-based format. It was coordinated by an Emergency Medicine Specialty Practice Pharmacist. Topic discussions were led by a multidisciplinary team including pharmacists, physicians, nurses, and administrators, to mimic the Emergency Department (ED) environment. Class enrollment was set at a maximum capacity of sixteen 3rd year Doctor of Pharmacy students. Discussion topics included essential aspects of emergency medicine and connected to concepts studied in other pharmacy courses. Weekly case-based learning assignments promoted independent critical thinking and use of drug information resources. To assist students in preparation for class, the focus of these cases was the topic covered in the upcoming class. Each student completed either a shadowing experience in the local tertiary care academic medical center ED or a ride-along experience with an emergency medical services team. At course completion, students were given one week to provide anonymous, voluntary instructor and course feedback through the university's standardized evaluation process. The feedback format was a 5-point Likert scale, with five indicating strongly agree or excellent and one indicating strongly disagree or poor. Students were encouraged to add free text comments. IRB approval was granted for this project.

Results: The Emergency Medicine Pharmacotherapy elective has been offered to students three consecutive years. Course enrollment was at capacity at the close of registration each year. The course was ranked as intellectually stimulating (4.7-4.9/5) and received an overall rating of excellent (4.9-5.0/5) each year. Open-ended free text responses from students included feedback that the course was inspiring, motivating and helped to promote pursuance of a pharmacy residency in emergency medicine. In addition the feedback regarding the multidisciplinary approach confirmed that this was an effective teaching method. Direct feedback from faculty on

the elective showed an appreciation for the opportunity and each enjoyed being engaged with the students.

Conclusion: An elective course in Emergency Medicine Pharmacotherapy actively engaged students in an interdisciplinary experience and met ACPE curriculum requirements. The course was positively reflected on by PharmD students and encouraged students future goals of practice in an Emergency Medicine discipline.

Category: Emergency Medicine / Emergency Room

Title: Response by a pharmacy department at a tertiary academic medical center to the 2013 Boston Marathon Bombing

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Purpose: Effective crisis response requires multi-disciplinary communication and rapid action. Our goals are to highlight the experience of the Brigham and Women's Hospital pharmacy department's response to the 2013 Boston Marathon Bombing, to discuss the role of the pharmacist in a crisis response, and to identify potential learning opportunities for a future mass casualty event.

Methods: Our initial response targeted three general areas: staffing, supplies, and communication. For staffing, we increased the number of pharmacists and technicians in the emergency department (ED), code cart room, central pharmacy, operating room (OR) and sterile products room (SPR). To ensure adequate supplies were available, inventory on the ED automatic dispensing cabinets (ADC) was assessed for vaccines, antibiotics and vasoactive medications. ED pharmacists prepared emergent intravenous medications in the ED, while the SPR bolstered our supply of intravenous medications for patients in the ED and OR. Due to increased security, the hospital staff had limited access to the ED posing a logistical challenge. Provisions were made to ensure the delivery of supplies, such as Total Parenteral Nutrition (TPN), for admitted patients due to a hospital lock-down during the event. In Boston, all cellular phone coverage was non-functional; therefore we formulated a comprehensive plan utilizing email and face to face communication for the timely dissemination of information to pharmacy staff.

Results: Within 30 minutes of the event, 19 survivors arrived in the ED. The ED provided care for a total of 39 survivors. Additional staff were deployed to the ED (5 pharmacists), code cart room (3 pharmacists, 1 technician), central pharmacy (3 pharmacists, 3 technicians), OR pharmacy (1 pharmacist, 2 technicians) and SPR (1 pharmacist, 1 technician). The pharmacy supervisor on-call provided hourly email updates to the department to include relevant clinical information. The pharmacist-in-charge, triaged calls from staff and facilitated supply requests. In the ED, a "charge pharmacist" rounded with ED team leaders for updates. Four pharmacists were assigned to each of the ED ADCs to facilitate quick medication distribution. One ED pharmacist was assigned to approve ED orders and answer drug-related questions. During the event there was a 33% increase in the number of ED ADC transactions compared to average daily use.

Additional vaccines, antibiotics, and rapid sequence intubation medications were promptly made available to the ED. Penicillin was bulk manufactured and sent to the ED and 7 weight-based gentamicin doses were calculated and mixed by the pharmacists in the ED for open fractures.

Conclusion: Mass casualty events are rare and a rapid, comprehensive pharmacy department response is critical. The lessons learned from the 2013 Boston Marathon Bombings provide key insight into coordinated efforts surrounding communication and resource utilization. These lessons will assist other institutions prepare for these tragic yet ever more common events.

5-074

Category: General Clinical Practice

Title: Utilizing an admission medication reconciliation process pilot to initiate a pharmacy practice model change with clinical pharmacists in a community hospital

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Purpose: Accurate admission medication histories are essential to ensure effective medication reconciliation and appropriate therapy. There is a significant amount of errors associated with the current medication reconciliation process, which has the potential of having a negative downstream impact on patient care. Technology and process corrective initiatives have not improved the error rate appreciatively and were often problematic. The objective of the pilot is to decrease the error rate by identifying the best process and resource to perform the task. The expected results would be used to justify changing the pharmacy practice model to direct patient care services.

Methods: A pilot was designed on the hypothesis that a pharmacist would obtain a more accurate admission medication history than a nurse. The twelve week pilot was conducted Monday through Friday during peak admission times between 0930 and 1800. The pilot pharmacist was stationed in the emergency department and performed medication histories on all admitted patients within the window of that shift. During periods in which there were no admissions the pharmacist assisted with any emergent issues that were within the scope of practice. The auditing pharmacists were two clinical pharmacists currently on staff. Auditing was performed Tuesday through Friday by comparing an equal number of medication histories taken by a nurse versus the pilot pharmacist. Each auditing pharmacist reperformed medication histories on high risk patients. The different types of errors recorded included wrong drug, wrong dose, wrong interval, duplication, missing information, drug omission, wrong strength, and documentation errors. Extended care facility patients were compared to patients admitted from home to determine any trends. Total number of errors and the total number of patients with errors were calculated along with the corresponding percentages.

Results: The pilot pharmacist was able to perform up to 16 medication histories within an 8 hour shift, representing 42 percent of patients admitted per day. The pharmacists error rate was lower than the nurses error rate from the beginning. Moreover, after week 8 that margin increased significantly due to the pharmacists learning curve. Results of the last five weeks of the pilot were as follows: nursing had 87.5 percent of patients with at least one medication error as compared to 18.87 percent for the pharmacist; nursing had 50.34 percent of medications with an error, as compared to 2.5 percent for the pharmacist. The highest percentages of nursing errors

were missing information, drug omissions, and wrong drug. The error rates for patients from extended care facilities versus those admitted from home were similar. It became evident that obtaining an accurate medication history was a complex process with multiple failure points. Patients did not always recall medication information within 24 hours of admission. The potential of errors increased with polypharmacy as well as the use of multiple treating physicians and community pharmacies. There is a significant learning curve associated with developing a strong competency for taking an accurate medication history.

Conclusion: There was a significant improvement in the accuracy of medication histories taken by a pharmacist as compared to the current practice in which a nurse performs the function. The positive return on investment that was primarily associated with error avoidance coupled with improved patient safety was sufficient to secure senior leaderships approval for additional pharmacists. The positive downstream impact of the pilot was that it demonstrated that utilizing the most appropriate resource is logical, efficient, safer, and cost effective. Consequently, medication associated functions that have defaulted to nursing should be performed by pharmacists in a more direct patient care model.

Category: General Clinical Practice

Title: Current Practice Patterns and Barriers to Inpatient Diabetes and Hyperglycemia Management: A Survey of Health-System Pharmacists

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Purpose: Hospitals are addressing inpatient diabetes and glycemic control issues but face obstacles to implementation of QI programs and vary in their approach to management. Central to ensuring the safe and effective balancing act of achieving normoglycemia without hypoglycemia is the need for a multidisciplinary team of which pharmacists are key players. We sought to understand the educational needs of the target audience with respect to their practice setting, whether or not protocols for hyperglycemia and hypoglycemia were in place, level of involvement in glucose control strategies, and barriers these pharmacists face in efforts to improve inpatient hyperglycemia management.

Methods: A survey was developed to elicit information from health-system pharmacists around the United States who had pre-registered for a national symposium on how to improve safety and patient care in the hospital setting as it related to inpatient use of insulin therapy. The survey included questions about institution size, whether or not insulin protocols had been implemented for different patient populations (and to what degree), whether hypoglycemia protocols had been implemented (and to what degree), what glucose thresholds were used to initiate insulin therapy, what glucose thresholds were used to initiate interventions for hypoglycemia, and whether or not computerized order entry systems were in place for insulin. Also asked was what the role of the pharmacist was in diabetes management efforts and what barriers they faced, if any, to implementing a glucose control program. The surveys were distributed electronically in December 2012; 546 responses were collected and analyzed.

Results: Of the 584 preregistered, 546 completed the pre-activity survey. A total of 68% of learners (N=361) reported their institutions had fully/ partially implemented protocols for glucose control for critically ill patients; 7.3% (N=39) reported that their institutions had nothing planned, and 18.3% (N=97) did not know. For noncritically ill patients 57.7% (N=301) reported their institutions had fully/partially implemented protocols, while 9% (N=47) had nothing planned and 23.8% (N=124) did not know. When asked about protocols for hypoglycemia, 70.2% (N=363) had fully/partially implement protocols, and only 3.7% (N=19) had nothing planned. A significant percentage (22.2%, N=115) did not know. When asked about their role on their institutions diabetes care management team nearly 30% (N=152) reported that no team existed and 24.8% (N=129) were not a member of the team although a team existed. Barriers

encountered were related to physician resistance, nursing competence, and the use of sliding-scale insulin. This group of health-system pharmacists self-selected to attend the symposium, which may have had an impact on the results, i.e., they may have decided to attend because either they self-identified a gap in their own practice or they identified an institutional gap in the care of these patients prior to registering to attend.

Conclusion: Recognizing the potential biases of the sample, the results of this survey demonstrate a lack of fully implemented protocols in place to address hyperglycemia in both critically and non-critically ill patients. Although the situation was better in regard to protocols for hypoglycemia, room for improvement also exists. Of concern are the significant percentages of learners who were not aware if protocols existed. Given the significant number of institutions lacking a diabetes care team, there are significant opportunities for health-system pharmacists to promote a team approach to care and to enhance their place as part of an interdisciplinary team approach.

5-076

Category: General Clinical Practice

Title: Interdisciplinary rounding frequency and quality improvement in a long term acute care hospital network

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Purpose: Interdisciplinary rounding improves collaboration among care giver staff, leading to increased care reliability and quality, especially with medically complex patients. The relationship between quality of care and the frequency of patient rounding has not been studied in long term acute care hospitals (LTACHs), which primarily treat chronically critically ill and medically complex patients. Directors of Pharmacy (DOPs) at each of 110 LTACHs were surveyed on the frequency, type, and membership of patient rounding occurring at their hospitals; the association between characteristics of patient rounding and quality of care outcomes was examined.

Methods: Quality was measured by normalizing eight quality measures and weighting each hospital according to their rank relative to all 110 LTACHs; specific indicators included rates for: falls (with injury), medication errors, hospital-acquired pressure ulcers (HAPUs), catheter-associated urinary tract infections (UTIs), central line associated bloodstream infections (CLABSIs), ventilator wean success, patient satisfaction, and readmission to short term acute care hospitals (STACHs). Averaging the ranks associated with all measures provided an indicator of overall quality. A polychoric correlation matrix was obtained for 10 survey questions that required response on an ordinal frequency scale and was used in a factor analysis, which produced three underlying frequency components: 1) rounding frequency; 2) antibiotic review frequency; and 3) medication and delirium-causing medication review frequency. The frequency of meeting separately with a physician within 48 hours of admission and the frequency of meeting weekly with a physician after an initial meeting were analyzed separately because these measures did not fit into the three frequency components and did not form a separate factor. Rounding factor scores and the frequency of meeting separately with a physician were entered into a series of step-wise linear regressions to predict each of the eight quality outcomes.

Results: Most DOPs (40%; N=42) indicated that the frequency of rounding occurred once per week; many (31%; N=32) indicated that rounding was sporadic. 7% (N=8) and 5% (N=6) specified a rounding frequency of two and three times per week, respectively; 12% (N=12) indicated that rounding occurred on a daily basis. An increase in medication and delirium-causing medication review was associated with an increase in overall quality [$F_{1,96} = 14.11$, $P <$

.001; adjusted R = .12] and vent weaning success [$F_{1,96} = 4.15$, $P < .05$; $R = 0.04$; adjusted R = .03]. An increase in rounding frequency was associated with a decrease in CLABSI rates [$F_{1,96} = 5.18$, $P < .05$; adjusted R = .06] and a decrease in CAUTI rates [$F_{1,96} = 4.98$, $P < .05$; adjusted R = .04]. An increase in the frequency of meeting separately with a physician weekly after the initial meeting was associated with decreased readmission to STACH [$F_{1,96} = 8.47$, $P < .01$; adjusted R = .06].

Conclusion: Quality of care was associated with the frequency of rounding, review of medications, and screening for delirium-causing medications. Increased rounding frequency predicted lower hospital-acquired infection rates and more successful vent weaning. Increased frequency of meeting separately with a physician predicted lower STACH readmissions. In LTACHs, increased communication between physicians, DOPs, and direct care staff is associated with improvement of outcomes and quality of care, and reduced risk.

5-077

Category: General Clinical Practice

Title: Pharmacist led medication reconciliation and education program to reduce hospital readmission rates

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Purpose: Reducing hospital readmission rates is considered a marker of quality patient care and a potential way to control health care costs. However, the key intervention or interventions leading to reduced readmissions have not been defined. Previous studies investigating the impact of pharmacist led interventions to reduce readmission rates have produced mixed results. The purpose of this study was to determine the effectiveness of pharmacist led interventions on 30 day hospital readmission rates.

Methods: The study protocol was approved by the institutional review board. A clinical pharmacist provided medication reconciliation and discharge education to patients with an admitting diagnosis of heart failure (HF) and/or chronic obstructive lung disease (COPD). International classification of diseases codes (ICD-9) and previously documented problem codes were used to identify eligible patients. Patients older than 18 years admitted to the general medicine floor or intensive care unit were eligible for inclusion. Patients were excluded due to pregnancy, observation status, active treatment for malignancy, or admission for alcohol intoxication, substance abuse, dialysis, or an uncontrolled mental health disorder. Medication reconciliation and education were provided within 24 hours of admission and on the day of discharge. Patients were contacted by phone within 3 to 7 days of discharge to address questions or problems with their medication. Patients who received at least 1 of the 3 interventions during a 6 month period were compared to a control group consisting of patients admitted with HF and/or COPD during a 1 year period prior to initiation of the study. The primary outcome investigated was 30 day hospital readmission rates. The secondary outcome, potential cost savings, was calculated using 2013 Medicare reimbursements to the authors institution.

Results: Two hundred-thirty four patients received a pharmacist led intervention and were compared to a control population of 730. Patient groups were similar with regard to baseline demographic characteristics. COPD was present in 180 patients (76.9%) in intervention group and 490 patients (67.1%) in the historical group (P equals 0.005). HF was present in 127 patients (48.7%) in the intervention group and 388 patients (59.3%) in the historical group (P equals 0.004). Pharmacist intervention resulted in reduced 30 day readmission rates for patients with COPD and/or HF (21.4% 30 day readmission rate in intervention group versus 28.2% in historical group; relative risk 0.76; 95 percent CI, 0.58 to 0.99; P equals 0.039). We calculated

that the described interventions would prevent approximately 31 readmissions per year with a potential cost savings of \$400,000.

Conclusion: Our data suggest that incorporation of a pharmacist into the discharge medication reconciliation and education process decreases 30 day readmission rates. Decreased 30 day readmission rates may reduce health care costs while improving the quality of patient care. Further studies are necessary to determine the applicability of these interventions to patients with other medical conditions.

5-078

Category: General Clinical Practice

Title: Improving the confidence of residents to complete a research project through a one-day research forum

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Purpose: ASHP standards for PGY-1 programs require residents to complete a project during their training. Many residents begin training with minimal project management skills and need guidance. The Student and Resident Affairs Committee of the Georgia Society of Health-System Pharmacists provides a one-day Residency Research Forum focused in four areas (statistics, IRB and HIPAA overview, basics of protocol writing & selecting outcomes, and time management). Residents from around the state in their second month of training are invited to participate. The purpose of this study was to determine the effects of this program on the residents confidence levels in these four areas.

Methods: This study was approved by the institutional review board. All participating residents were invited to complete a survey that included 34 Likert-scale questions (5=strongly agree, 4 = agree, 3 = not sure, 2 = disagree, 1 = strongly disagree) in four domains: 11 statistics, 9 IRB/HIPAA, 8 protocol writing/outcomes, and 6 time management. The 8-hour program was presented by preceptors and residency directors from programs across the state of Georgia. The program opened with a presentation (15 minutes) about the importance of professional involvement through state organizations. Teaching pedagogies included lectures (2 hours for statistics, 1 hour for IRB/HIPAA overview, 1 hour for protocol writing/ outcomes, and 20 minutes for time management) and problem-based learning exercises focused on previously completed projects (1 hour). Residents who had completed training 2 months prior presented their project findings and lessons learned. They also engaged participants in a question and answer session. Participants were invited to complete the survey again at the conclusion of the program. The primary outcome measure was a change in pre and post survey mean values in the four domain areas. The secondary outcome measure assessed the effects of the program on participant networking with residents and preceptors from other programs.

Results: Seventy residents participated in the program. Forty-one (59%) completed the pre and post-program surveys. Seventeen participants completed the post-program survey only and those data were not included in the analysis. Significant changes ($p < 0.05$) between the pre- and post-program mean scores were noted in 11/11 (100%), 8/9 (89%), 8/8 (100%), and 4/6 (67%) of the statistics, IRB/HIPAA, protocol writing/outcomes, and time management questions, respectively. Significant changes in mean scores were also noted for 2/4 (50%) of the questions about networking residents and preceptors from other programs.

Conclusion: A one day residency research forum that employs a variety of teaching and learning strategies can improve the confidence of participants in areas necessary for successful project completion. A follow-up study will be conducted in a future cohort to assess whether changes in knowledge occur as a result of program participation.

5-079

Category: General Clinical Practice

Title: Development of a rapid intravenous desensitization protocol for iodixanol in patients with radiocontrast-induced anaphylactoid reactions refractory to standard premedication therapy

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Purpose: Anaphylactoid reactions to radiocontrast media have traditionally been managed with premedication using corticosteroids and antihistamines. A patient with unstable angina and known severe radiocontrast sensitivity underwent cardiac catheterization. Despite pretreatment with diphenhydramine and large amounts of prednisone, she immediately developed profound hypotension and facial urticaria after initial injection of 2 mL iodixanol (iso-osmolar radiocontrast agent), necessitating abortion of the catheterization. There is limited literature to guide management of patients who have failed standard premedication strategies. This protocol was designed to address this need such that these patients can undergo procedures requiring iodixanol in a timely manner.

Methods: A clinical pharmacist developed a desensitization protocol for iodixanol. Premedications for the protocol were based on recommendations by an immunologist, with changes made where necessary for formulary considerations. The dose titration for iodixanol was adapted from a previous case report. Premedications included prednisone 1 mg/kg administered three times over 13 hours prior to desensitization, and diphenhydramine 50 mg intravenously, ephedrine 25 mg intravenously, and ranitidine 300 mg orally one hour prior to desensitization. The desensitization schedule consisted of doubling concentrations of iodixanol mixed in normal saline given every 10 minutes. A total of eleven 5 mL doses of increasing concentration of iodixanol (from 1:1000 to undiluted) were administered intravenously over 100 minutes. The protocol was executed immediately prior to the procedures requiring iodixanol.

Results: The desensitization protocol was administered to the aforementioned patient with unstable angina who needed to undergo coronary angiography. She remained hemodynamically stable and asymptomatic throughout the duration of the protocol. She was subsequently taken to the cardiac catheterization lab where she received 300 mL of iodixanol without incident. She exhibited no signs of anaphylactoid reaction for the duration of her hospital stay and was discharged home. Four months later, this patient presented again to hospital with non-ST-elevation myocardial infarction requiring repeat coronary angiography. She was desensitized according to the protocol and on this occasion, she developed facial flushing and a pruritic rash on her chest during desensitization, which resolved with 50 mg intravenous diphenhydramine. Coronary angiography was successfully completed with no further complications. The following day, the patient was desensitized a third time for percutaneous coronary intervention. She did not

exhibit any signs of reaction until the next day when she developed generalized pruritus and facial erythema. These symptoms resolved with a single dose of 25 mg intravenous diphenhydramine.

Conclusion: This rapid desensitization protocol for iodixanol was successful in allowing a patient who developed a severe anaphylactoid reaction to radiocontrast media despite standard pretreatment to undergo procedures requiring contrast, in particular iodixanol. Any signs of sensitivity, such as pruritus and erythema, were readily treatable. This protocol can be considered for future use in other similarly sensitive patients undergoing procedures requiring iodixanol.

5-080

Category: General Clinical Practice

Title: Improving transitions in care: implementing a fully integrated outpatient retail pharmacy within a healthcare institution

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Purpose: Across the nation, healthcare systems are identifying and developing possible solutions related to readmissions. Potential drivers include fragmented systems across the continuum of care, barriers to medication access during transition from hospital to home, and patient non-adherence. One of the many initiatives a 719 bed teaching hospital identified was to open an on-site outpatient retail pharmacy and integrate clinical pharmacists to identify patients who are at higher risk of being readmitted. The goal of this collaboration of efforts was to improve transitions in care as well as reduce readmissions, increase patient satisfaction, and decrease overall costs to the institution.

Methods: A new clinical pharmacy specialist position was created to address transitions in care with a focus on medication therapy. The specialist worked extensively with the departments of quality assurance, case management, social work, and nursing to gather data identifying patients at high risk of readmission to the hospital. A report was developed from available internal software programs. Data was queried to identify patients at higher risk of readmission. The data was used to formulate medication interventions that may improve care transitions. Potential interventions are brought to the attention of team caring for the patient. In parallel, an outpatient retail pharmacy was under development. One of the goals identified for the outpatient retail pharmacy was to improve the patient discharge process component of safe transitions related to discharge medications. The clinical specialist collaborated with the outpatient pharmacy staff to develop the following three levels of service for patients who opt in: drop off and pick up prescriptions, bedside delivery with offer for pharmacist consultation, or for patients identified as a higher risk of readmission: bedside delivery along with comprehensive medication teaching provided by a pharmacist at hospital discharge.

Results: The clinical pharmacy specialist assigned to transitions in care functions as an effective liaison between inpatient and outpatient teams. By utilizing previous experiences, the specialist has been able to provide insight on barriers that often occur in outpatient settings such as miscommunication amongst providers regarding medication additions or changes, allergy information, laboratory data, etc. A fully integrated computer system at on-site retail pharmacy provides a major benefit as it allows dispensing pharmacists access to patient information such as lab values, drug allergies, physician notes, and medication histories. In addition, if interventions

are identified, the prescribing physician may be directly contacted prior to discharge. Using the reports assisted the clinical specialist in identifying patients at higher risk. Patients identified on this report and those who opted into utilizing the on-site retail pharmacy were provided with medication and consultation at discharge. During patient review additional opportunities for intervention have been identified including adjudicating insurance claims of newly prescribed medications. Having an on-site retail pharmacy has helped avoid negative outcomes, often a hospital readmission, by identifying and decreasing some barriers that patients often experience: minimizing the chance of not filling a new medication or experiencing a delay in therapy.

Conclusion: An on-site integrated retail pharmacy and a dedicated clinical pharmacy specialist improved transitions in care at our organization by improving dispensing pharmacists access to patient health information, enabling multidisciplinary collaboration on discharge medications while patients are still on-site, minimizing barriers to accessing discharge medications, and providing opportunities for enhanced medication education for high-risk patients.

5-081

Category: General Clinical Practice

Title: Evaluation of pharmacist interventions as part of a patient aligned care team model in a home based primary care population

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Purpose: Pharmacists have been shown to assist providers and make valuable recommendations regarding patient care as members of several different types of interdisciplinary teams. Benefits of pharmacist participation on multidisciplinary teams include improved patient and provider education, reduced drug related errors, reduced emergency department visits and hospitalizations, and cost savings. The purpose of this study was to assess the impact of the Patient Aligned Care Team (PACT) model on implementation of pharmacist interventions in the Home Based Primary Care (HBPC) population.

Methods: The institutional review board approved this pilot project including a retrospective electronic chart review of data collected from patient charts in the HBPC program. Patients included transitioned care from a primary care provider (PCP) at the medical center to a PCP within HBPC. Patients followed by palliative care were excluded. The primary outcome was assessment of the percent change in pharmacist recommendation implementation post transition to the HBPC PACT model measured with a paired t-test with alpha less than 0.05. Secondary outcomes included assessment of the mean and median number of minutes spent on patient chart reviews by the pharmacist, number of pharmacist recommendations per chart review, types of pharmacist recommended interventions and the percentage of different types of pharmacist recommended interventions. A 20 percent increase in percent of pharmacist recommendations implemented post transition to the HBPC PACT model was expected.

Results: Out of 236 patient charts reviewed, 43 met criteria. The mean difference of pharmacist recommendation implementation after conversion to PACT was 21.2 percent (95 percent CI, -0.44 to 0.01, P equals 0.0011). The mean number of minutes pharmacists spent on patient chart reviews was 43.4 minutes and the mean number of recommendations per chart review was 1.8. The most common pharmacist recommendations were to check lab values, add indications to patient problem list, and to discontinue medications (23.5, 15.7, and 15.7 percent, respectively)

Conclusion: Pharmacist recommendations were implemented significantly more frequently when the patient had an HBPC PCP but the HBPC interdisciplinary team played an important role in patient care regardless of who the PCP was. The clinical significance of these effects must be determined in longer term clinical trials evaluating emergency department visits, hospitalizations, and cost savings.

Category: General Clinical Practice

Title: Implementation of a pharmacist directed protocol for safely transitioning patients on intravenous insulin to a subcutaneous insulin regimen

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Purpose: This project was designed to implement and measure the effects of a pharmacy directed intravenous insulin discontinuation process in a semi-rural, community hospital. Accepted guidelines recommend that a subcutaneous long acting insulin dose should be given 1 to 4 hours prior to the discontinuation of intravenous insulin therapy. Although protocols already existed stressing the importance of overlapping insulin coverage in transitioning patients, it was proposed that involving a pharmacist would improve compliance.

Methods: A protocol was developed that required physicians to discontinue intravenous insulin by ordering a newly created Discontinue IV Insulin Order Set. This order set contained orders for subcutaneous insulin, labs, and a pharmacy consult. The consult alerted pharmacists that IV insulin therapy was ending and authorized them to coordinate the transition. This involved timing the ordered doses of subcutaneous insulin and then discontinuing intravenous insulin when appropriate. The effectiveness of this process was assessed by auditing a randomly selected sample of patient cases before and after the introduction of the pharmacy directed protocol. IV insulin was considered to be transitioned appropriately if long acting subcutaneous insulin was administered at least one hour prior to discontinuation of IV insulin therapy.

Results: Prior to the introduction of the pharmacy directed process only 23 percent (8/34) of patients were discontinued from IV insulin therapy appropriately. Fifty nine percent (20/34) were discontinued inappropriately resulting in, on average, an 8 hour gap in basal insulin coverage. The remaining 18 percent (6/34) never received a subcutaneous long acting agent prior to discharge from the hospital. Three months after the introduction of the pharmacy monitored discontinuation protocol, a follow up audit was performed. This audit showed that the number of patients transitioned appropriately had increased to 64 percent (14/22) and the number of inappropriate transitions was reduced to 32 percent (7/22). The number of patients that never received a subcutaneous long acting agent prior to discharge was reduced to 4 percent (1/22). The new process is dependent on the physicians actually using the order set, and it was only used in 65 percent of the available opportunities. When the physicians used the new protocol over 85 percent were executed appropriately.

Conclusion: After the introduction of a pharmacy directed Discontinue IV Insulin Drip Order Set, the overall number of patients that were correctly transitioned from IV insulin to subcutaneous insulin more than doubled. Pharmacy involvement had a positive effect on the safe transition from IV to SC insulin in this hospital setting. Continuing efforts are expected to yield improving results as hospitalist fully incorporate the pharmacy order set into their practice.

Future studies may explore how an increase in appropriate transitions affected factors such as length of stay and elevated blood glucose values.

Category: General Clinical Practice

Title: Implementation of a staff pharmacist-lead heart failure education program in a community hospital.

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Purpose: Healthcare is undergoing significant changes with reimbursement shifting to an outcomes-based system. Reimbursement from the Centers for Medicare and Medicaid Services is now being tied to 30-day readmission rates for three conditions, including heart failure (HF). Though there is great opportunity for pharmacists to have an impact on readmission rates, community hospitals are less likely to have staff pharmacists experienced in providing disease-state counseling. This project evaluates the impact of a staff pharmacist-led heart failure education program on 30-day readmission rates in the setting of a community hospital.

Methods: A new pharmacy-driven HF patient education program was implemented at University Hospitals Geauga Medical Center starting in October 2012. In an effort to capture all potential HF cases, patients were identified by their admitting diagnosis, including shortness of breath, dyspnea, pneumonia, chronic obstructive pulmonary disease, and congestive heart failure. After identifying appropriate patients, education was provided that included HF symptoms, dietary recommendations, weight monitoring, common HF medications and smoking cessation (if applicable). Starting in January 2013, patients identified as not having a scale, a tool necessary to monitor daily weights, were provided with a scale free of charge. To help improve patient identification and education rates, an incentive program was developed to reward pharmacists with the highest participation rates. Data was collected from November 2012 to April 2013. The primary endpoint was 30-day readmission rates during the intervention period compared to the same time period 1 year prior to the intervention. Secondary endpoints included the percentage of patients admitted for HF that were educated by a pharmacist, number of months the 30-day readmission rates were below target values and number of complimentary scales provided to patients.

Results: Mean 30-day readmission rates did not differ significantly between the intervention period and the historical rates 1 year prior to the intervention (24% vs 22%, $p=0.75$). Over the six-month intervention, the pharmacists educated a total of 58 patients or 46% of patients admitted with a diagnosis of HF. Though only 41% of HF patients were counseled during the first month, by the final month, 100% of HF patients were counseled. Monthly HF readmission rates decreased from 36% in November to 14% in April, with rates below target for 3 of the 6 intervention months. A total of 22 complimentary scales were provided to 30% of HF patients.

Conclusion: Our data supports that a pharmacy-driven HF patient education programs can be implemented in a community hospital. The trend toward a reduced monthly readmission rate compared to historical controls suggests a benefit in reducing HF readmissions, though more data is needed before a cause and effect relationship can be established.

Category: General Clinical Practice

Title: Reducing inappropriate prescribing of proton pump inhibitors in a community hospital

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Purpose: Overuse of stress ulcer prophylaxis (SUP) is a widespread issue in hospitals throughout the country. The inappropriate use of SUP is associated with increased cost and risks. In addition, overutilization of proton pump inhibitors (PPIs) for SUP is a growing concern. Certain adverse events associated with SUP, such as community-acquired pneumonia, *C. difficile* infection, and fractures occur more frequently with PPIs than with H2-antagonists. The purpose of this study was to optimize the use of pantoprazole in general medical-surgical units through pharmacist-driven implementation of hospital-approved guidelines.

Methods: This prospective, IRB-approved study included patients ≥ 18 years of age ordered pantoprazole 40 mg orally or intravenously on general medical-surgical units. Patients who met the study criteria were further evaluated for the need of pantoprazole, as per hospital-approved PPI prescribing criteria. The number of pantoprazole doses dispensed over a three-month period prior to the study was compared to the three-month period during the study. The number of recommendations made and/or accepted, the rates of untoward GI symptoms in patients in which pantoprazole was discontinued, and potential cost savings were also assessed.

Results: Overall, 182 patients were evaluated. 143 patients met the PPI prescribing criteria. The remaining 39 patients did not meet any of the PPI prescribing criteria and were thus deemed eligible for discontinuation of SUP altogether or change from pantoprazole to famotidine. A total of 59 clinical interventions were made. Clinical interventions which required contacting a physician included discontinuation of SUP ($n = 5$), or a change from pantoprazole to famotidine ($n = 26$). The most common reasons for continuation of pantoprazole included use of a PPI as an outpatient ($n = 100$), NSAID use ($n = 18$), and high-dose steroid use ($n = 21$). No adverse GI effects were observed or reported in patients in whom therapy was discontinued. The total number of pantoprazole doses dispensed prior to the study and during the study were 30,450 and 31,110, respectively. In addition, the potential yearly cost savings associated with elimination of this 22% inappropriate usage altogether at BHM is \$36,923.16. If patients were started on famotidine instead during their hospital admission, the potential yearly cost savings would be \$27,964.58.

Conclusion: The acceptance of clinical recommendations was high at 94%. In addition, pantoprazole was appropriately ordered as per prescribing criteria in 78% of patients reviewed, which equates to a 22% opportunity for intervening on inappropriately prescribed PPIs. Due to

the large percentage of appropriate use, a limited number of interventions were made which resulted in no effect on the total number of doses dispensed. No adverse GI effects were reported in patients in whom therapy was discontinued. As a result, pharmacist interventions did not appear to put patients at increased risk of GI bleed.

5-085

Category: General Clinical Practice

Title: Novel communication strategies for notification, substitution and conservation of drugs during critical drug shortages

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Purpose: Drug shortages are a common obstacle in today's hospital pharmacist world. Challenges exist in communicating drug shortages to affected staff as well as keeping everyone up to date on current drug stock and substitution strategies. This project was designed to identify potential drug shortages, standardize documentation and communication of drug shortages, and improve conservation of crucial drug supplies.

Methods: The pharmacy clinical team developed a process for critical drug shortages. The process included identification, standardized documentation memos, and communication of critical drug shortages to affected prescribers and pharmacy staff. The process also indicated the need for one primary clinical pharmacist to lead shortage initiatives and allow for continuity with the pharmacy materials coordinator and staff. Identification of drug shortages was obtained through several sources: ASHP drug shortage website, FDA drug shortage website and the pharmacy materials coordinator. Documentation of drug shortages has been maintained through the use of a color coded spreadsheet. The color coded spreadsheet utilizes the following: Red = drug unavailable, Yellow = drug restricted/critically low, Green = no restrictions at this time. Documentation also included parties contacted, form of contact, date of contact and alternative treatments when available. Communication involved email and/or phone call to affected staff as well as weekly pharmacy huddle communications

Results: Pharmacy managers and pharmacists were educated on the color coded spreadsheet. The color coded spreadsheet was added to a pharmacy department website accessible at all work stations throughout the hospital. Physician division chiefs and nurse managers were informed of critical shortages through email and/or phone call and instructed to relay drug shortages to their staff. All communications to nurses and physicians have been documented since the process was implemented. A brief daily report and a weekly in-depth report on drug shortages sent to nursing and administrative leadership has been implemented. The drug shortage process was approved through the Pharmacy and Therapeutics committee.

Conclusion: As a result of the drug shortage implementation process, critical drug shortages were identified earlier allowing conservation of remaining supplies. Documentation with color coding allowed pharmacists to discern availability/restriction of drugs quickly and with less confusion. Communication between departments: pharmacy, nursing, and medical staff allowed

for smooth transitions to alternative agents when necessary. As a result of the process, the medical staff is more engaged in drug shortage problem.

Category: General Clinical Practice

Title: Evaluation of inhaler use in ambulatory and hospitalized patients

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Purpose: There are dozens of commercially available inhaler-delivered medications, many of which are manufactured and dispensed with their own unique patented device. Management of chronic diseases such as asthma and chronic obstructive pulmonary disease (COPD) rely on these inhaled medications as mainstays of therapy, but anticipated clinical response is dependent upon proper use of these delivery devices. Our objective was to determine the level of appropriate use of medication inhalers in ambulatory and hospitalized patients and identify any steps that were performed incorrectly.

Methods: Hospitalized and ambulatory care patients presently using inhalers were identified and evaluated for their ability to properly use their medication inhalers based on the respective manufacturers instructions for use. Incorrect steps were identified along with the medication name, inhaler device type, patient demographic information, and who taught the patient how to use the inhaler. Patients who were found to perform any steps incorrectly were taught the proper manner of inhaler use. This project was approved by the institutional review board and informed consent was obtained from patients prior to all evaluations.

Results: 131 patients made up of 61 men (46.6%) and 70 women (53.4%) with an overall mean age of 65.4 years using a total of 214 inhalers were evaluated. The mean period of inhaler use by patients was 9.1 years. More than half (119/131; 55.6%) of inhalers were used in a manner inconsistent with the manufacturers instructions. Most types of inhalers evaluated had at least one episode of misuse by a patient. The inhalers with the highest rates of misuse were Advair Diskus (fluticasone and salmeterol; 27/55 patients), Flovent HFA (fluticasone; 6/9 patients), Proair HFA (albuterol; 33/39 patients), Dulera (mometasone and formoterol; 1/1 patient), Proventil HFA (albuterol; 1/2 patients), Combivent (ipratropium and albuterol; 20/20 patients), and Ventolin HFA (albuterol; 20/20 patients). The steps most frequently performed incorrectly included improper priming (35/214), lack of exhaling before administration (16/214), improper timing of actuation and inhalation (16/214), and lack of routine and proper cleaning (22/214). Other steps performed incorrectly included lack of rinsing their mouth after use (9/214), lack of shaking inhaler prior to administration (7/214), lack of holding ones breath after inhaler actuation (12/214), and improper position of inhaler in mouth (4/214). Those inhalers with the lowest rate of misuse were albuterol MDI (5/15 patients), Advair HFA (fluticasone and salmeterol; 1/5 patients), Alupent (metaproterenol; 0/1 patient), Flovent Diskus (fluticasone; 0/1 patient), Spiriva HandiHaler (tiotropium; 3/38 patients), and Symbicort (budesonide and formoterol; 2/8 patients).

Only eight patients (3.7%) stated that they were taught how to use their inhalers by a pharmacist, while the majority were trained by a physician (n=122; 57.0%) or nurse (n=39; 18.2%).

Conclusion: Patients with respiratory conditions frequently misuse their prescribed inhalers. Pharmacists could play an active role in educating patients to ensure appropriate use of inhalers and possibly improve the management of pulmonary diseases.

Category: Herbals / Alternative Medicines

Title: Adverse drug reactions of herbal medicines during pregnancy

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Purpose: The use of herbal remedies has increased despite lack of scientific evidence about their efficacy and safety during pregnancy. This cross-sectional study aimed to explore the usage of herbal products during pregnancy among Iranian women based on their sociodemographic characteristics, assessment of side effects in mothers and ultimately their possible effects on neonates

Methods: In total, 250 postpartum Iranian women and their newborns were recruited during first few days of postnatal period at Arash Hospital in Tehran, Iran. Data were collected in the course of a face-to-face interview by a pharmacist and completion of a questionnaire including maternal sociodemographic characteristics, medical history, pregnancy-related conditions and all medicines used during pregnancy. Questions were used to gather the relevant information for up to one month before pregnancy. Medical notes were scrutinized for neonatal characteristics.

Results: Of all 253 eligible women, 250 (98.8%) agreed to participate. At least one herbal medicine (licensed or unlicensed) was used by 79.6% of the interviewed subjects. The use of herbal drugs was significantly higher amongst the older, higher-educated and primiparous women. Ginger, thyme, mint and rosemary were the most common used licensed herbs. The most frequently unlicensed herbal remedies were mint, frankincense, olive oil and borage. Vitamins, minerals and antibiotics were on the top of the list of non-herbal drugs. Nausea, vomiting and constipation were the most reported side effects with licensed herbal remedies. Regarding neonates, respiratory distress syndrome and jaundice were the most prevalent problems at birth.

Conclusion: This study indicates that taking herbal and non-herbal medications during pregnancy is common among Iranian women. Although not always safe, herbals are mostly used according to personal judgment without informing health care professions. Pregnancy care providers should be aware of the potential risks and benefits of the commonly used herbal drugs by the pregnant women.

Category: Herbals / Alternative Medicines

Title: Herbs and oral antitumoral agents interactions

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Purpose: In the last years the number of oral antitumoral agents has increased, as well as the use of herbs among people who have cancer. We need to be aware of these facts to provide a good pharmaceutical care. The aim of this study was to identify herbs which can interact with oral antitumoral drugs and to identify herbs which could interfere with the effect of antitumoral drugs.

Methods: We reviewed pharmacological properties of most commonly used oral antitumoral drugs in our environment. We analyzed herbal medicines listed by European Medicines Agency's (EMA) Committee on Herbal Medicinal Products and which are available in the EMAs web. We looked for herb-drug interactions. Ovid search was made using the medical subject heading Herb-drug interactions and selecting review articles. The search covered the period 1966 until November 2012. Besides, we search in other medical databases (Lexi-Comp, Micromedex and Natural Medicines Comprehensive Database) to complete information.

Results: We included a total of 44 drugs and 198 herbs in our study. Drugs were metabolized primarily by CYP3A4 (22 drugs), CYP1A2 (2), CYP2D6 (2), CYP2C9 (2), P-glycoprotein (2) and UGT (2). Interactions with cytochroms were described with 54 herbs. Cytochroms affected were CYP3A4 (inhibition: 49 herbs, induction: 8 herbs), CYP2C9 (inhibition: 15, induction: 1), CYP2D6 (inhibition: 14, induction: 3), CYP1A2 (inhibition: 11, induction: 1), CYP2C19 (inhibition: 9), CYP2C8 (inhibition: 4), CYP2E1 (inhibition: 1), CYP2A6 (induction: 1) and CYP450 undetermined (inhibition: 4, induction: 1). UDP-glucuronosyltransferase was modulated by 8 herbs and inhibited by 1. P-glycoprotein was induced by 4 herbs and inhibited by 3 herbs. Antioxidant effects were found in 10 herbs, so they can interfere with the effect of some antitumoral drugs. Other 7 herbs had estrogenic activity, leading to a potential antagonism of antiestrogenic drugs. In addition, one can downregulate EGFR expression and other one can inhibit the therapeutic effect of bortezomib.

Conclusion: Herb regulation is different from drugs one, so it is difficult to find information on their pharmacological characteristics and interaction. Most of the collected information is theoretical or based in clinical reports. Patients should be asked if they take herbs and pharmacists who attend them should be aware of potential interactions.

Category: Home Care

Title: Development of a homecare educational program in Japan

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Purpose: Pharmacists are becoming increasingly more involved in homecare in Japan, and expectations regarding their roles are growing. However, many issues related to implementation remain, in particular the lack of support measures for improving the skill levels of pharmacists. We herein conducted a questionnaire survey on the awareness of pharmacists regarding homecare, and developed an educational program for supporting the implementation of homecare by pharmacists.

Methods: A total of 46 pharmacists working at a pharmacy with or without experience in homecare (men and women aged between 22 and 38 years) were asked to indicate the skills they wished to improve, issues and concerns regarding work, and any opinions. Pharmacists without experience were additionally asked to indicate their desire to become involved in homecare. An educational program was developed based on the results of the survey.

Results: A total of 97% of pharmacists not engaging in homecare (n=29) responded that they "wished to experience homecare". Over 80% of pharmacists engaging in homecare (n=17) had concerns and problems. Regardless of experience, many pharmacists indicated the need to learn the wide range of knowledge necessary for providing homecare as well as the use of medical devices and other techniques. Pharmacists also provided opinions regarding approaches for cooperation and interaction with other professions as well as patient assessment, such as related concerns and the desire to improve the relevant skills. The educational program was structured as follows: Step 1: Basic knowledge and techniques Step 2: Assessment skills Step 3: Development of care plans and approaches for interaction with other professions Steps 2 and 3 were based primarily on case studies.

Conclusion: Many of the issues faced by pharmacists engaging in homecare were those that could not be resolved simply by acquiring knowledge or techniques, indicating the importance of promoting practical ability systematically. Future issues include nurturing pharmacists capable of providing homecare by implementing the present educational program, verifying the usefulness of the program in clinical practice, and promoting homecare in Japan.

5-090

Category: Home Care

Title: Development of a physical assessment model for homecare patients in Japan

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Purpose: The proportion of the total population aged over 65 years (the population aging rate) in Japan, a super-aging society, surpassed 23% in 2012, a rate not previously seen in any other country. Homecare has been promoted as a means of reducing national medical expenses, and expectations for pharmacists in homecare have been growing. However, the promotion of pharmacists roles in homecare has been hindered by the lack of physical assessment skills .No tools for supporting pharmacists and homecare staff in regard to the above have been developed. We therefore developed a physical assessment model for homecare patients.

Methods: The present tool was developed with the objective of improving care for homecare patients through the following: 1. Comprehensive assessment of the effects of drugs on patients conditions by pharmacists, and 2. Cooperation and consultation with other professions based on the results of these assessments.

Results: Areas of problems and needs associated with homecare were classified into 19 items. For each area of problems and needs, a Secondary assessment sheet consisting of Initial assessment for checking the presence or absence of problems and needs and assessment of any problems and needs that arise from three perspectives, specifically the disease and physical condition, lifestyle and environment, and drugs, was created. This sheet was designed in such a way that pharmacists could assess the effects of drugs and provide care in cooperation with other care staff.

Conclusion: The use of the present model enabled homecare staff to make detailed assessments of the effects of drugs in cooperation with each other. The present model is expected to facilitate the prevention or management of previously overlooked issues, and to enable pharmacists to actively engage in interventions for patients. Verification of the effectiveness of the present model in actual practice is warranted.

5-091

Category: I.V. Therapy / Infusion Devices

Title: A strategic plan to improve the IV admixture services.

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Purpose: The purpose is to improve and increase the efficiency of IV admixture services and to reduce the I.V. medications wastage.

Methods: An analysis for workload of the intravenous admixture services at PSMMC was done for one year. Revising the current situation and resources assessment was the first stage. The amount of workload was initially identified which represented 9,000 IV prescriptions monthly. Then the workload was analysed by pharmacy location, month, shift, and type of medications. At the same time, an evaluation for the existing workflow and the process such as the manual IV Kardex was conducted. The second stage was started by refining the original idea into developing a strategic plan to improve intravenous admixture services. The strategy aimed to reduce both medication wastages and I.V. preparation time. Furthermore; the strategy focus was on improving quality and not on cost-cutting initiatives. In addition, the centre of improving must be on the patient quality and safety as well as, to Improve the system, rather than working harder. Finally, the strategy aimed to recognize Key Performance Indicators (KPIs) for the intravenous admixture services and benchmark data to measure.

Results: As result, many changes were suggested. A plan was made to implement online IV Kardex. Premixed DOPamine and DOBUTamine were requested. Also, DOPamine and DOBUTamine standard drip rate charts were developed and online infusion calculator was published on hospital intranet. The proposed solutions include also, standardisation the doses of various I.V. medications, use reconstitution products i.e.(Mini-bag plusTM, Add-vantageTM). Beside that a plan to expand the satellite pharmacies services to new wards based on the workload for these wards. In order, to reduce the medication wastages, the sources of this wastage were investigated. The sources were identified and include poor communication and transportation between the pharmacy and nurse stations. Online pharmacy-nursing communication form was started and a suggestion to hospital administration to implement Pneumatic tube systems. Another barrier that has been identified is the pharmacy layout and medications location, printers or computers. Therefore, the IV section was redesigned to increase the efficiency of services. The automations were suggested as potential solutions to overcome the possible sources for medication errors. Hence, the PSMMC started to implement the smart pump and robots for compounding non-hazardous and hazardous IV preparations to reduce errors and protect pharmacy staff from hazardous IV preparations.

Conclusion: We succeed to achieve our aim to improve and increase the efficiency of IV admixture services by reducing the turnaround time (TAT), reduce the workload by using commercially premixed preparations and to reduce the I.V. medications wastage.

Category: Infectious Diseases

Title: Assessing the efficacy and use of tigecycline in Lebanese hospitals

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Purpose: Tigecycline represent a new class of antibiotic called the glycylcycline that was approved by the food and drug administration (FDA) in June 2005 for IV use in adults community acquired pneumonia, complicated skin and soft tissue infection (cSSTI) and complicated intra-abdominal infection, A recent meta-analysis in June 2012, reviewed 13 clinical trials showed inferiority of tigecycline to other antibiotics by showing increase in mortality due to failure of therapy. The purpose of the study is to evaluate the efficacy and the use of tigecycline in Lebanese hospitals.

Methods: The institutional review board approved this retrospective observational multi-center study that included immunocompetent males and non-pregnant females of 18 years and older who took tigecycline for more than 4 days in a period between 2011 till the end of 2012. All patients who were neutropenic or immunocompromised were excluded. For the primary outcome measure was assessment of treatment failure defined by patient death or a switch or an addition of another antibiotic on tigecycline, the secondary outcome measure was to evaluate the use of tigecycline with its approved indications.

Results: A total of 150 hospitalized patients were screened in whom 57 patients met inclusion criteria, 63.2 percent of patients started originally on tigecycline, and 36.8 percent switched to or had tigecycline added to their initial antibiotic therapy. 77 percent of patients included had respiratory tract infections while 19 percent of patients had complicated skin and soft tissue infections and only 1 patient out of the whole 57 patients had intra-abdominal infection. Interestingly patients who was admitted for respiratory tract infections, none of them fits the criteria for community acquired pneumonia which is the FDA indication for tigecycline in respiratory tract infection, But instead all the respiratory tract infection patients were either nosocomial acquired infection which was associated with a very poor outcome and drastically affected the results since it was found that patients cSSTI have 0.03 times the odds of having treatment failure compared with patients with complicated respiratory tract infection 95 percent CI [0.003-0.32] (P < 0.004). Regarding the treatment efficacy, 61 percent (22/ 36) of patients started on tigecycline have failed the treatment, 38 percent (14/36) of patients started on tigecycline have benefit from the treatment, 66 percent (14/21) of patients who are started on conventional therapy, failed the treatment after adding tigecycline and 33 percent (7/21) of the patients who started on the conventional therapy benefit from the treatment after adding

tigecycline. It was found that almost 60 percent of the patients with respiratory tract infection have acinetobacter baumannii where nearly all the patients had treatment failure. Septic shock has a major effect on treatment response as it was shown that patients with septic shock have 48.1 the odds of treatment failure compared to non-septic patients 95 percent CI [2.96-782.6] (P < 0.006).

Conclusion: Tigecycline is being used in Lebanese hospitals as a last line resort in complicated nosocomial respiratory tract infections after a trial of many other antibiotics that failed to eradicate the bacteria and also a lot of isolates showed acinetobacter baumannii which is one of the most resistant bacteria and difficult to treat. The role of the pharmacist to control the use of tigecycline is very important in Lebanese hospitals. The pharmacist recommendations for the use of tigecycline in cSSTI were approved by the attending physician. Studies with larger sample size are needed to evaluate the use and efficacy of tigecycline.

5-093

Category: Infectious Diseases

Title: Impact of Automatic Stop Times for Empiric Broad Spectrum Antibiotics

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Purpose: Efforts to promote appropriate use of broad spectrum antimicrobials at UAB Hospital have included numerous medication usage evaluations to establish guidelines for use. Prescribing practices which promote inappropriate antimicrobial use are failures to de-escalate or discontinue therapy based on culture results. In 2012, an antimicrobial stewardship initiative placed an automatic 7 day stop time for empiric therapy in the computerized physician order entry system for broad spectrum antimicrobials. The purpose of this project is to evaluate the impact of automatic stop times on antibiotic utilization at the unit level and to assess compliance with the initiative for select antimicrobial agents.

Methods: Unit level data in days of therapy/1000 patient days (DOT/1000 patient days) was generated monthly utilizing Medmined reports. This data has been utilized to compare antimicrobial usage 6 months pre and post implementation of this initiative. To assess compliance, prospective audits were conducted for patients receiving vancomycin (December 2012) and piperacillin-tazobactam (February 2013). Beginning in January, 104 inpatients receiving vancomycin were identified, and 98 were included in the final analysis. In February, 105 inpatients receiving piperacillin-tazobactam were identified, and 100 were included in the final analysis. Electronic medical records were reviewed to determine initial intent of the order (empiric/culture proven), duration of therapy, and orders for empiric therapy renewed without stewardship approval. Any patient safety concerns resulting from antibiotic therapy being discontinued inappropriately were evaluated utilizing StarsWeb database.

Results: Vancomycin was used empirically 82.7% of the time, while 17.3% of the orders were culture driven. The average duration of therapy for vancomycin for all orders was 6.8 days, while the average duration for all empiric orders was 5 days (range: 1-19 days). Of the 81 empiric orders for vancomycin, 74% were discontinued (or the patient was discharged) prior to reaching the default duration of 7 days. The average duration for orders stopped prior to the default duration of 7 days was 3.6 days. Empiric treatment was extended beyond 7 days in 5 patients, and 2 were extended without infectious disease approval. Piperacillin-tazobactam was used empirically 60% of the time, while 40% of the orders were culture driven. The average duration of therapy for piperacillin-tazobactam for all orders was 9.1 days, while the average duration for all empiric orders was 6.8 days (range: 2-21 days). Of the 60 empiric orders for piperacillin-tazobactam, 63% were discontinued prior to reaching the default duration of 7 days. The average duration for orders stopped prior to reaching the default duration of 7 days was 4.5 days. Empiric

treatment was extended beyond 7 days in 12 patients, and 6 were extended without infectious disease approval.

Conclusion: Overall, there was a 6% reduction in average monthly DOT/1000 patient days for vancomycin and 5% for piperacillin-tazobactam at the hospital level. Reductions at the unit level varied from a 30% decrease to a 25% increase 6 months pre and post implementation of the initiative. The average time to culture finalization was 3 days (range: 2-5 days). There were no incidents reported via StarsWeb. Based on observed durations of empiric therapy (<5days) for piperacillin-tazobactam and vancomycin, culture finalization time frame (<5days), and no evidence of patient safety issues, the Antimicrobial Stewardship Committee further reduced empiric therapy to five days.

5-094

Category: Infectious Diseases

Title: Comparison of in vitro susceptibilities of extended spectrum beta-lactamase (ESBL) producing *Escherichia coli* to imipenem and ertapenem in a four-hospital health system

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Purpose: To determine if susceptibility to imipenem/cilistatin in ESBL producing *E. coli* serves an appropriate surrogate marker for susceptibility to ertapenem in the Scripps Health System. This would allow ertapenem to be used as the carbapenem of choice for ESBL *E. coli*; preserving imipenem for pseudomonal infections.

Methods: ESBL producing *E. coli* isolates were collected from August 2012 to April 2013. Samples from sputum, wound, urine, and blood cultures were analyzed. Isolates were excluded if they were collected from patients <18 years of age. Susceptibility to imipenem was determined on a standard microbiology panel, using the BD Phoenix™ System. Ertapenem susceptibility was determined by a manual Epsilon test (Etest), using the current Clinical Laboratory Standards Institute minimum inhibitory concentration (MIC) breakpoints. All intermediately-resistant organisms were considered resistant.

Results: A total of 202 isolates were screened for inclusion criteria. Two isolates were excluded for age < 18 years, and twenty were excluded because of duplication. A total of 180 isolates were included for analysis. The primary source of isolates was urine (79%), wound cultures (13%), blood (5%), and sputum (3%). The isolates were found to be 178/180 (98.9%) susceptible to imipenem, and 177/180 (98.3%) susceptible to ertapenem (OR= 58.3, 95% CI, 2.91 to 1168.79, p= 0.008).

Conclusion: A statistically significant relationship in the susceptibilities of ESBL producing *E. coli* to imipenem compared to ertapenem was found. Overall, resistance to carbapenems in our health system remains low, allowing for ertapenem to be used as the carbapenem of choice for ESBL *E. coli*. The generalizability of this data outside Scripps Health is limited due to low resistance rates seen in the isolates tested

Category: Infectious Diseases

Title: Clinical Laboratory Based Assay Methodologies May Underestimate and Increase Variability of Vancomycin Protein Binding in Patients

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Purpose: Given the threat of methicillin resistance among *Staphylococcus aureus*, vancomycin has become one of the most widely used antimicrobials in clinical practice. Because only free drug is responsible for antimicrobial activity, it is important to understand the protein binding of vancomycin. Unfortunately, protein binding reported in the literature ranges from 0 to 96.3% and methodology varies widely. The purpose of this study was to evaluate and compare the protein binding of vancomycin in patients using a clinical or laboratory derived assay methodology and evaluate potential patient characteristics accounting for alterations in binding.

Methods: This study was a prospective, non-interventional cohort study conducted at Hartford Hospital, a single center, tertiary care medical center. The protocol was reviewed and approved by Hartford Hospitals Institutional Review Board and a waiver of consent was granted. Fifty-five hospitalized patients identified from August 2011 to November 2011 receiving vancomycin for a suspected or documented infection and requiring therapeutic drug monitoring were identified. Vancomycin protein binding studies were conducted using ultracentrifugation from 63 blood samples collected for therapeutic drug monitoring as part of clinical practice. Total and free drug concentrations were assayed using high performance liquid chromatography (HPLC) and in the clinical laboratory using fluorescence polarization immunoassay (FPIA). Multivariate linear regression analysis was performed to identify patient variables that were predictive of vancomycin protein binding.

Results: The average protein binding was statistically lower and more variable when assayed by FPIA as compared with HPLC (47.3 13.0% vs. 54.6 9.5%, $p < 0.001$). Multivariate analyses showed that after controlling for days of vancomycin therapy, patients residing in the intensive care unit had a protein binding value that was 8.4% lower than non-ICU patients ($p = 0.005$).

Conclusion: Using research laboratory based HPLC methodology; we identified an average vancomycin protein binding of 54.6% with considerably less variability than reported in the literature using clinical based assay methodologies. Further, we identified patient factors that may likewise impact this value. Future studies of vancomycin protein binding should consider use of a non-clinical assay as to minimize methodological induced variability.

Category: Infectious Diseases

Title: Assessment of treatment for urinary tract infections and impact of an educational strategy on appropriate antibiotic prescribing

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Purpose: Inappropriate treatment of patients with urinary tract infections (UTI), and asymptomatic bacteriuria can contribute to an increased risk of Clostridium difficile infection (CDI), and other untoward consequences, such as the development of increased resistance. These risks have been linked to cumulative antibiotic exposure in hospitalized patients. The purpose of this initiative was to review current practices for the treatment of UTI, develop guidelines, and employ an educational strategy to appropriately assess and treat patients with UTI in a community-based teaching medical center.

Methods: A retrospective chart review was performed to identify patients coded as having UTI present on admission in March of 2012 (Phase-I). Patients who were being treated for any other possible infection other than UTI were excluded from the analysis. Baseline demographics were collected including age, sex, healthcare-associated [HCA] versus community acquired [CA]), antibiotic treatment, and urinary pathogens and susceptibilities. Antibiotic treatment was then analyzed by type of UTI (complicated versus uncomplicated), and HCA versus CA. Following phase-I, an educational presentation was prepared comparing current practices to consensus guidelines and institutional specific guidelines were developed. This data was then presented to various disciplines throughout the medical center. During May 2013, a second retrospective chart review was performed, identifying patients receiving antibiotics for the treatment of UTI according to the indication selected through the computerized physician order entry system (Phase-II). The primary objective was to assess empiric antibiotic selection in patients with UTI presenting from the community, and the rate of de-escalation of antibiotic therapy before and after the educational initiative.

Results: Fifty patients were included in the Phase-I analysis. Cefepime was the most frequently prescribed empiric antibiotic (50%). This trend was similar among all patients with either complicated (52.4%), or uncomplicated cystitis (48.3%), and among CA-UTI patients (51.7%). Ciprofloxacin was the second most commonly prescribed empiric antibiotic (24%). Of 29 CA-UTI patients, 14 had positive urine cultures. Eleven isolates were gram-negative organisms susceptible to cefazolin, and the other three isolates were Enterococci. In patients receiving broad-spectrum antibiotics, 42% of patients could have had antibiotic therapy de-escalated to a

narrower spectrum agent. Of these patients only 14% had antibiotic therapy de-escalated. Sixteen percent of the all patients had a negative urine culture but continued to receive antibiotics. Phase-II included 58 patients (32 CA-UTI, and 26 HCA-UTI) retrospectively reviewed during May 2013. Of 32 patients with CA-UTI, 34.4% were empirically prescribed cefepime. Cefazolin was the second most prescribed empiric antibiotic (28.1%). There were 13 gram-negative organisms isolated from CA-UTI patients and 100% were susceptible to cefazolin; 2 of 7 patients (28%) had antibiotics discontinued when the urine culture was negative. A total of 53% of patients qualified for de-escalation of their anti-infective regimen. De-escalation was performed in 54.8% of these patients.

Conclusion: Initial treatment for UTI frequently results in initiation of broad-spectrum antibiotics, while most uncomplicated UTIs presenting from the community can be effectively treated with more narrow-spectrum agents. Following the implementation of institutional specific guidelines and an educational initiative, we observed an improvement in empiric antibiotic selection, and rate of de-escalation of therapy. Further interventions, including prospective audit and feedback, are necessary in order to further optimize antibiotic therapy in patients with UTI, and eliminate antibiotic therapy in asymptomatic patients.

Category: Infectious Diseases

Title: Point prevalence review as a tool to identify trends in antimicrobial use and opportunities for improvement in a community teaching hospital

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Purpose: Inappropriate antimicrobial use is associated with increased morbidity, mortality and hospital cost. Antimicrobial stewardship programs have been widely implemented to optimize antimicrobial use and to improve patient care while minimizing antimicrobial resistance. A sustainable program utilizes different approaches to assess antimicrobial use, and identify opportunities for improvement periodically. In our institution an antimicrobial stewardship program has been in place for more than five years. It was recently determined to conduct a point prevalence review in order to identify trends in antimicrobial usage and prescribing patterns. The objective of this project was to evaluate the value of a point prevalence review, and identify targets for quality improvement.

Methods: For the point prevalence review, the following procedure was followed. An electronic computerized report was generated identifying all patients receiving antimicrobials on a specific date (NICU and outpatient areas are excluded). Pertinent information collected included: number of hospitalized patients on the specific date (this number was generated from the electronic census report), number of patients receiving oral and intravenous antibiotics (ophthalmic, topical and single doses were excluded), and total number of patients receiving antimicrobials. Pharmacy PGY1 residents reviewed patients charts to collect the following data to determine appropriateness of antibiotic therapy; indication for antibiotic therapy, cultures and source of cultures. Appropriateness was determined by reviewing the data with the infectious disease physician in collaboration with pharmacy. This process was repeated every six months and presented to the pharmacy and therapeutics committee.

Results: Four point prevalence reports from a single day every six months shown the following results; Number of hospitalized patients was similar for all four dates. And the number of patients receiving antibiotics was also similar 75(49%), 67(45%), 75(45%), and 76(52%). The most frequently prescribed antibiotic was cefazolin 17 (23%), 24 (36%), 15(20%), 17(22%). followed by intravenous vancomycin 10 (13%), 12(18%), 12(18%), 16(21%), then piperacillin/tazobactam 4(5%), 5(7%), 5(7%), 9(12%)] for the same reports 1,2,3 and 4 consecutively. For report 1 and 2, the number of patients with appropriate antibiotics treatment determined by infectious disease was 63(84%), 62(93%) while the number of patients with cultures obtained was 51(68%), 34(51%) Utilization of daptomycin, linezolid, micafunin, and meropenem was low on all four dates.

Conclusion: Point prevalence review can be a good source of information providing useful data on prescribing trends while providing a valuable learning experience for pharmacy residents on the appropriateness of antibiotic use. Over this two year period, increased trends and high utilization of vancomycin and piperacillin/tazobactam have been identified and targeted for medication use evaluation. This demonstrates that results from a point prevalence review can be utilized in identifying targets for improvement and monitoring the effectiveness of our antibiotics policies.

5-098

Category: Infectious Diseases

Title: Appropriateness of Gonorrhea Treatment in Patients Seen at the Jefferson County Department of Public Health

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Purpose: Gonorrhea is a sexually infection disease caused by the gram-negative bacteria *Neisseria gonorrhoeae*. Ceftriaxone and either azithromycin or doxycycline for Chlamydia coverage are recommended. Proper therapy is required to decrease transmission rates and the risk of complications. The objective of this retrospective review is to evaluate the degree to which prescribers at the Jefferson County Department of Health (JCDH) adhere to the Centers for Disease Control and Prevention (CDC) guidelines for the treatment of gonorrhea.

Methods: Following institutional review board approval, a retrospective chart review of patients at JCDH with a diagnosis of gonorrhea between January 1, 2011 and June 29, 2012 was conducted. Using International Classification of Disease-9 codes, patients were identified in the electronic medical record. Appropriate therapy was defined as ceftriaxone plus either azithromycin or doxycycline. Upon completion of the review, descriptive statistical analyses, including the proportion of patients receiving proper therapy and proportion of patients seeing a physician or a non-physician, were conducted. A chi-square test was used to evaluate if non-physicians (including clinicians of unknown training) and physicians are equally likely to prescribe appropriate drug treatment. All analyses were conducted by the principal investigator with the assistance of a statistician. Assuming a type 1 error rate of 0.05, the study had a power of 90% to detect a difference.

Results: A total of 1138 patient visits were identified using the electronic medical record after excluding 46 for protocol reasons. Overall, 96% of patients received appropriate therapy. 94.8% of patients were treated by a non-physician. Of those treated by a physician, 89.8% received appropriate therapy compared to 96.3% of patients who were treated by a non-physician received appropriate therapy ($\chi^2=6.023$; $DF=1$; $p < 0.014$). There was no difference in the number of penicillin allergic patients seen by physicians and non-physicians.

Conclusion: There is a statistically significant association between the provider and appropriate therapy. Studies such as this can be used to support and further the role and importance of midlevel providers in patient care. Limitations of this study include lack of assessment of whether infections were first infections or recurrent, and whether physicians were more likely to see complicated gonorrheal infections.

5-099

Category: Infectious Diseases

Title: Ceftaroline fosamil for the treatment of acute bacterial skin and skin structure infections in obese patients: CAPTURE study experience

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Purpose: Ceftaroline fosamil (CPT-F) is approved for the treatment of acute bacterial skin and skin structure infections (ABSSSI) and community-acquired bacterial pneumonia (CABP). CAPTURE (Clinical Assessment Program and Teflaro Utilization Registry) is a multicenter retrospective cohort study describing patients treated with CPT-F for these infections in the United States. Obese patients are known to have a slow response to antibiotic therapy for ABSSSI and are at risk for significant morbidity and mortality due to ABSSSI. Experience with CPT-F in the treatment of ABSSSI in obese patients is presented and compared with patients with a normal body mass index (BMI).

Methods: Data were collected at participating centers by random selection and chart review of patients at least 18 years of age at time of treatment with CPT-F between August 2011 and February 2013 and included demographic information, disease characteristics, antibiotic use, and outcomes. The institutional review board at each site approved the protocol. Data collection did not occur until at least 30 days after last dose of CPT-F to ensure that all data was collected retrospectively. The evaluable population consisted of those who received at least 2 consecutive doses of CPT-F through August 2012 and at least 4 consecutive doses of CPT-F thereafter in addition to determination of a clinical outcome by the Investigator. Clinical success was defined as clinical cure or clinical improvement plus a change to oral agents or discontinuation of all antibiotic therapy. Obesity is defined by the Centers for Disease Control and Prevention as a BMI of 30 or greater and a normal BMI is defined as 18.5 to 24.9.

Results: Of the 1030 evaluable ABSSSI patients, 527 (51 percent) were obese and 201 (20 percent) had normal BMI. Among obese patients the median/mean age was 58/57 (SD plus/minus 16, range 18 to 96), males comprised 47 percent, diabetes occurred in 54 percent. The most common types of infections in obese patients included deep/extensive cellulitis (59 percent), skin or skin structure infection associated with diabetes mellitus/peripheral vascular disease (39 percent), and major abscess (16 percent). Antibiotics were used prior to CPT-F in 78 percent of obese patients compared with 78 percent of patients with normal BMI. Concurrent antibiotics were used in 37 percent of obese patients compared with 43 percent of patients with normal BMI. The median/mean duration of CPT-F therapy in obese patients was 5.0/6.0 days

(SD plus/minus 4.9) compared with patients with normal BMI in who the median/mean duration of therapy was 4.0/6.0 days (SD plus/minus 5.3). Clinical success was 88 percent in obese patients and 86 percent in patients with normal BMI. In obese patients 77 percent were discharged to home and 22 percent to another care facility; in normal BMI patients discharge was to home in 75 percent and to another care facility in 23 percent.

Conclusion: Clinical success with CPT-F was similarly high in obese patients with ABSSSI compared with patients of normal BMI given considerable use of CPT-F as second-line therapy in both groups. Discharge destination of obese patients was similar to those with normal BMI. These data support the use of CPT-F as a viable treatment option in obese patients with ABSSSI

Category: Infectious Diseases

Title: Metric development to assess the impact of adding an infectious diseases pharmacist to an existing antimicrobial stewardship program

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Purpose: The infectious diseases trained clinical pharmacist is a pillar of an institution's antimicrobial stewardship team. Their expertise is an important component of both passive and active stewardship activities as outlined by the Infectious Diseases Society and Society of Healthcare Epidemiology of America guidelines. Defined daily dose (DDD) per 1,000 patient days was used to assess the impact of adding a full time antimicrobial stewardship pharmacist at a 719-bed teaching hospital.

Methods: A full time antimicrobial stewardship pharmacist joined an existing multidisciplinary team, which included members from infectious diseases, microbiology, infection control, information technology, administration and pharmacy. Clinical activities of the pharmacist include prospective audit and feedback to providers on selected patients on empiric broad spectrum antimicrobials that were continued beyond the institution's recommended three day stop date, participation in educational programs for the resident house staff and infectious diseases fellows, and participation in multidisciplinary rounds. Antimicrobial utilization in treatment days was calculated using the stewardship metric defined daily dose (DDD), as outlined by the World Health Organization. DDD is accepted as one of several objective metrics for measuring antimicrobial consumption which is independent from cost data.

Results: Antimicrobial utilization in treatment days was normalized per 1,000 patient days for both internal and external benchmarking. Utilization of total antimicrobials, when compared from the fiscal year prior to the addition of an antimicrobial stewardship clinical pharmacist to the fiscal year following showed an overall decrease of 8 percent. Broad spectrum agents; piperacillin/tazobactam, cefepime, and meropenem individually had decreases of 6 percent, 18 percent and 3 percent respectively in treatment days. Several agents (i.e.: ceftriaxone) had increases in treatment days, which correlated with de-escalation from a broad empiric regimen to a narrower treatment regimen. Assessment of agents with increases in treatment days will be used to guide future clinical pharmacist intervention.

Conclusion: Use of DDD per 1,000 patient days provides an objective measure to assess the impact of the activities an infectious diseases pharmacist conducts. This metric will continue to

be measured and utilized to assess antimicrobial utilization and identify areas of improvement or target individual antimicrobial agents requiring further review.

Category: Infectious Diseases

Title: Assessment of tolerability of boceprevir and telaprevir in the veteran population

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Purpose: Since FDA approval of direct acting antivirals (DAA) boceprevir (BOC) and telaprevir (TVR) in May 2011, the standard of care for patients infected with hepatitis c virus (HCV) was changed to include one of the DAA in combination with pegylated interferon (pegINF alfa 2a or 2b) and ribavirin (RBV). Treatment with DAA is a challenge because triple therapy is associated with many more side effects and a higher pill burden. This study will assess the tolerability and virologic response of BOC and TVR based therapy in the veteran population in comparison to clinical trials.

Methods: The institutional review board approved this retrospective chart review. Medical records of patients infected with HCV treated with BOC or TVR in addition to pegINF alfa 2a or 2b and RBV from September 1, 2011 to September 1, 2012 were reviewed. Each chart was evaluated for tolerability of treatment, incidence of non- hematologic adverse events (infection, rash, hepatic decompensation, pruritis and dysgeusia), and hematologic adverse events including anemia, categorized based on hemoglobin level, grade 2 (8.0 to less than 9.5 grams/deciliter), grade 3 (6.5 to less than 8.0 grams/deciliter), and grade 4 (less than 6.5 grams/deciliter); thrombocytopenia categorized as mild (50,000 to 150,000 platelets/cubic millimeters), moderate (25,000 to 50,000 platelets/cubic millimeters) and severe (less than 25,000 platelets/cubic millimeters); neutropenia assessed and categorized based neutrophil count as grade 3 (500 to less than 750 cubic millimeters) and grade 4 (less than 500 per cubic millimeters). On treatment virologic responses for week 4, week 12, end of treatment response (ETR), sustained virologic response (SVR), virologic responses for treatment nave, previous treatment partial responders, null responders and relapsers if available. Secondary outcomes included a cost-analysis between BOC naive patients eligible for shortened treatment.

Results: BOC naive population experienced a higher incidence of dysgeusia (43.8 versus 37 percent; P equals 0.745), rash (50 versus 25 percent; P equals 0.045), pruritis (68.8 versus 24 percent; P equals 0.003); grade 4 neutropenia (11.7 versus 6 percent; P equals 0.646), moderate thrombocytopenia (18.8 versus 3 percent; P less than 0.019), discontinuation rates from side effects (18.8 versus 12 percent; P equal 0.456) and a lower SVR (62.5 versus 67 percent; P equals 0.358) in comparison to the SPRINT-2 trial. BOC experienced population had a higher incidence of dysgeusia (68.8 versus 21 percent; P less than 0.001), rash (62.5 versus 15.1 percent; P less than 0.001), pruritis (56.3 versus 18.9 percent; P less than 0.001); grade 3 neutropenia (25 versus 19.1 percent; P equals 0.481), grade 2 anemia (37.5 versus 26 percent; P

equals 0.294), discontinuation rates from side effects (37.5 versus 8 percent; P equals 0.009) and a lower SVR (53.8 versus 62.5 percent; P equals 0.753) in comparison to the RESPOND-2 trial. TVR naive and experienced populations had a higher incidence of non-hematologic adverse events in comparison to ADVANCE and REALIZE respectively. TVR hematologic adverse events were not assessed due to differences in adverse event grading.

Conclusion: Veterans experienced a higher incidence of side effects in comparison to clinical trials resulting in higher discontinuation rates due to adverse events. Discontinuation rates from patients not meeting futility rules was lower at this institution in comparison to the clinical trials. Sustained virologic response rates were comparable to clinical trials even though overall discontinuation rates were higher. The higher incidence of co-morbidities seen in the veteran population including, diabetes, smoking, depression, and baseline cirrhosis may have contribute to higher discontinuation rates.

Category: Infectious Diseases

Title: Development of an Outpatient Parenteral Antimicrobial Therapy (OPAT) Monitoring Program using Collaborative Drug Therapy Management (CDTM) at a Tertiary Academic Medical Center

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Purpose: Outpatient parenteral antimicrobial therapy (OPAT) is defined as the administration of at least 2 doses of parenteral antimicrobial on different days without hospitalization. Goals of OPAT include safe and effective completion of therapy, improved patient comfort and convenience, and avoidance of complications and costs associated with prolonged hospital stays. Our 800-bed tertiary academic medical center discharges about 1,700 patients on approximately 2,200 courses of OPAT annually. Due to this high volume, we sought to develop a systematic process to track and monitor OPAT patients with aims to reduce physician workload and improve patient outcomes and satisfaction.

Methods: We performed a retrospective review to identify all patients discharged on OPAT from February 1, 2012 until March 1, 2013 from our institution. Medical records were reviewed to determine if an infectious diseases consultation was performed prior to hospital discharge. A random sample of 50 medical records was performed to estimate the percentage of patients receiving parenteral antimicrobial therapy in which an oral therapeutic alternative may have been feasible. Rates of OPAT-related emergency department visits and 30-, 60-, and 90-day hospital readmissions were collected for all patients discharged on OPAT. Incident line-related events during the OPAT course were also recorded and evaluated. Adverse event rates were calculated among users of antimicrobials associated with high risk for toxicity. Finally, a review of care coordination, outside home infusion agencies, nursing, and physician processes for tracking and monitoring patients was performed to determine future processes for patient management and workflow. Subsequent development of a systematic process for referral of patients to the OPAT service as well as tracking, monitoring and adjusting therapy using a physician-pharmacist CDTM protocol in the outpatient setting was developed.

Results: Inpatient infectious diseases consultation is required prior to enrollment in the OPAT service. In addition, a pharmacist-physician CDTM protocol was developed and approved by hospital administration and credentialing. This protocol provides a systematic approach to monitoring patients who are discharged on OPAT in accordance with state and federal pharmacy regulations. Under this agreement, pharmacists will obtain laboratory and clinical status reports

from patients as well as applicable outside agencies providing pharmacy and nursing services to patients. The agreement provides for the authorization to monitor and adjust antimicrobial therapy under infectious diseases physician supervision. Pharmacists may renew, modify the dose, infusion rate or frequency of administration of OPAT in instances of adverse reactions, changes in laboratory tests and/or to account for drug-drug interactions. Performance improvement activities aim to monitor rates of successful completion of therapy, adverse events, hospital readmission rates, and patient satisfaction. Added measures will include rates of serum drug concentrations within the desired range, percent of appropriate dose adjustments by pharmacists and types of interventions and time spent performing clinical pharmacist activities.

Conclusion: An interdisciplinary approach to care and monitoring of patients receiving OPAT is essential for safe and effective therapy outside the hospital environment. We propose a collaborative effort including care coordinators, infectious diseases physicians, nurses and clinical pharmacists to ensure proactive monitoring of therapy to optimize care and patient satisfaction. Requiring inpatient infectious diseases consultations and employing a team-based approach to monitoring under a collaborative practice agreement may serve to improve patient outcomes. Future directions include quality assurance of this initiative and reimbursement for services.

Category: Infectious Diseases

Title: Collaboration between Antimicrobial Stewardship and P&T Committee reduces unjustified prescribing of daptomycin and curtails daptomycin expenditures

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Purpose: Injudicious use of antibiotics fosters emergence of resistant organisms and wastes valuable financial resources. Inappropriate use of daptomycin was identified following a medication use evaluation (MUE) conducted at our institution. This study documents how collaboration between the antimicrobial stewardship program (ASP) and the P&T Committee reduced unjustified prescribing of daptomycin and curtailed daptomycin-related expenditures at an inner city, tertiary-care, academic medical center.

Methods: A daptomycin MUE (DMUE) documented the number of defined daily doses (Dapto DDD) dispensed by pharmacy and the number of orders that did not meet Daptomycin Use Criteria (DUC) at our institution from January, 2012 through June, 2012 (Pre-ASP/P&T Intervention Phase). Data on daptomycin expenditures (Dapto \$) were obtained from pharmacy purchasing invoices received during the Pre-ASP/P&T Intervention Phase. On July 1, 2012, the P&T Committee implemented a Daptomycin Order-set to facilitate compliance with DUC and tasked the ASP pharmacist with its enforcement. The P&T Committee requested a prospective DMUE to be conducted from July, 2012 through June, 2013 to assess the impact of the ASP/P&T Committee collaboration on DUC compliance and on Dapto DDD (Post-ASP/P&T Intervention Phase). Post-ASP/P&T Intervention Phase data for Dapto \$ were obtained from pharmacy purchasing invoices received during this second phase. Categorical data are presented as percent score. Continuous data are presented as mean +/- standard deviation. Differences between Pre-ASP/P&T Intervention Phase and Post-ASP/P&T Intervention Phase regarding DUC compliance were assessed by Fisher's exact test. Differences between Pre-ASP/P&T Intervention Phase and Post-ASP/P&T Intervention Phase regarding Dapto DDD and Dapto \$ were assessed by student's t-test. P was set at < 0.05.

Results: Enforcement of DAUC by the ASP pharmacist improved compliance with DUC from 81% during the Pre-ASP/P&T Intervention Phase to 100% during the Post-ASP/P&T Intervention Phase ($P < 0.0001$). Dapto DDD dispensed by pharmacy were reduced significantly ($P = 0.03$) during the Post-ASP/P&T Intervention Phase (30.33 ± 24.55) when compared with the corresponding value during the Pre-ASP/P&T Intervention Phase (85 ± 43.46). Similarly, Dapto \$ fell significantly ($P = 0.01$) during the Post-ASP/P&T Intervention Phase ($\$2,551 \pm$

3,294) when compared with the corresponding value during the Pre-ASP/P&T Intervention Phase (21,859+/-12,107).

Conclusion: Collaboration between ASP and P&T Committee improved compliance with appropriate use criteria for daptomycin. Reducing the unjustified use of daptomycin substantially lowers both the number of DDD dispensed by pharmacy and the corresponding pharmacy expenditures used to procure the medication. Empowering ASP pharmacists to ensure compliance with appropriate use criteria can reduce the unjustified use of antibiotics and can yield considerable financial savings to the institution.

Category: Infectious Diseases

Title: Changes in antimicrobial sensitivities for high-risk pathogens during implementation of an antimicrobial stewardship

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Purpose: The primary goals of antimicrobial stewardship programs (ASPs) are to reduce burden of exposure to antimicrobial therapies and to safeguard against antimicrobial resistance. We implemented an ASP in Oct, 2011 to curtail antimicrobial resistance and reduce unnecessary antibiotic use at our inner city, tertiary medical care, teaching hospital. The objective of this study was to examine changes in antimicrobial sensitivities for high-risk pathogens (HRPs) from 2010 - 2012.

Methods: Susceptibility data for 7 Gram negative HRPs (i.e., *Enterobacter cloacae*; *Escherichia coli*; extended spectrum beta-lactamase positive (ESBL +) *Escherichia coli*; *Pseudomonas aeruginosa*; *Klebsiella pneumoniae*; ESBL+ *Klebsiella pneumoniae*; *Acinetobacter baumannii*) and 2 Gram positive HRPs (i.e., *Staph. aureus*; *Enterococcus faecalis*) to 12 antibiotics (i.e., piperacillin tazobactam; levofloxacin; ciprofloxacin; aztreonam; gentamicin; tobramycin; cefepime; ceftriaxone; vancomycin; clindamycin; tetracycline; and ampicillin) were collected from the 2010, 2011, and 2012 antibiogram databases at our institution. Resistant organisms were defined as those for whom < 50% of isolates tested were sensitive to the antibiotics selected. Cross-tabulation analysis was used compared the distribution of sensitive versus resistant isolates and the distribution of isolates with improved, worsened, or unchanged susceptibilities from 2010 through 2012. Data are presented as raw score. Statistical significance for between groups comparisons was determined by chi square test. Statistical significance was set at $P < 0.05$.

Results: The number of sensitive versus resistant isolates did not differ significantly ($P = 0.71$) between calendar years 2010, 2011, and 2012 (47 vs. 43, 49 vs. 39, and 52 vs. 36; respectively). Comparison of the distribution of isolates with improved, worsened, or unchanged sensitivities between Pre-ASP Implementation Phase (i.e., from 2010 to 2011) and Post ASP Implementation Phase (i.e., from 2011 to 2012) revealed that significantly more isolates were sensitive to the selected antibiotics during the Post ASP Implementation Phase ($n = 29$) when compared to the Pre-ASP Implementation Phase ($n = 9$); ($P = 0.0008$). There were less isolates with worsening sensitivities during the Post ASP Implementation Phase ($n = 15$) when compared to the Pre-ASP Implementation Phase ($n = 29$), but this difference did not reach statistical significance. Lastly, the number of isolates that with unchanged sensitivities was almost the same during the Post

ASP Implementation Phase (n = 54) when compared to the Pre-ASP Implementation Phase (n = 52).

Conclusion: A favorable trend was observed in susceptibilities for HRP's from 2011 - 2012 coinciding with implementation of our ASP. More research is needed to discern causality between the guiding of antibiotic therapies by the ASP pharmacist and the improvements in sensitivity observed in this study.

Category: Infectious Diseases

Title: Antimicrobial stewardship program curtails antibiotic expenditures

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Purpose: To examine the impact of an antimicrobial stewardship program (ASP) on monthly antibiotic expenditures at an inner-city, tertiary care, teaching hospital from October, 2010 through May, 2013.

Methods: Monthly data for antibiotic expenditures, patient census, and patient acuity level were compiled for computation of antibiotic expenditures per case mix adjusted patient days (\$AB/CMI-APD). Repeated measures analysis of variance was used to assess differences in monthly patient census and in monthly \$AB/CMI-APD from October 2010 through September 2011 (Pre-ASP) when compared with corresponding values for October 2011 through September 2012 (ASP Yr 1) and October 2012 through May 2013 (ASP Yr 2). Data are presented as mean +/- one standard deviation. Statistical significance was set at $P < 0.05$.

Results: The ASP reduced \$AB/CMI-APD during ASP Yr 2 (\$5.40+/-0.89) when compared to ASP Yr 1 (\$6.64+/-1.9) and Pre-ASP (\$6.30+/-1.3), but these differences did not reach statistical significance ($P = 0.274$). In contrast, patient census rose significantly ($P = 0.0009$) during ASP Yr 2 (13,640 +/-695) when compared with either ASP YR 1 (11,822+/-1,179) or Pre-ASP (11,859+/-642).

Conclusion: When compared with baseline data (i.e., Pre-ASP), the ASP's governance of antibiotic utilization led to a 14% relative reduction in antibiotic expenditures despite a 14% relative increase in patient census during the ASP's second year of existence at our institution.

Category: Infectious Diseases

Title: Does size matter? Antimicrobial usage variation- opportunities for cost savings and antimicrobial stewardship at the largest not for profit health care system in the US

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Purpose: Inappropriate antimicrobial use is associated with increased cost, significant patient harm, and infection control challenges with multidrug resistance, and *Clostridium difficile* infection. With the growing epidemic of antimicrobial resistance concern, we assessed antimicrobial utilization across 69 hospitals of our health system.

Methods: We evaluated systemic antimicrobial acquisition cost from 2010 to 2012. In addition to cost per patient day, daily defined dose (DDD) of systemic broad spectrum antibiotic classes including quinolone, carbapenem, piperacillin/tazobactam, streptogramin, tetracycline, macrolide, lipopeptide, oxazolidinone, third and fourth generation cephalosporin, and antifungal agents, including azole, polyene, echinocandin were calculated. We also compared hospital volume, including annual patient days, case mix index (CMI) and cost categories, evaluating changes over 3-year period.

Results: The 3-year period data included 9,456,762 patient days with 4,962,072 DDDs with a cost of \$124,222,245. There were no significant changes for individual hospitals in the mean antimicrobial use of targeted broad spectrum agents (DDD 0.77, 0.74, 0.8) or cost (\$14.8, \$14.2, \$13.8) per patient day for paired comparisons for 2010, 2011 and 2012 respectively. In 2012, hospitals with <50,000 patient days were likely to use more antimicrobials (DDD >1: 14/41, 34.1%; DDD <1: 27/41, 65.9%) than hospitals with >50,000 patient days (DDD >1: 2/28, 7.1%; DDD <1: 26/28, 92.9%; $p=0.009$). Lower antimicrobial cost hospitals tended to have continued cost reduction during the 3-years, in contrast to those with baseline high cost. In addition, hospitals with CMI <1 had higher cost (\$17.7 +/- 11.3) compared to hospitals with CMI >1 (\$12.7 +/- 5.4; $p=0.024$).

Conclusion: Our findings suggest that smaller size hospitals had more antimicrobial use than large hospitals and similar results were found in facilities with lower CMI. The analysis provides us a great tool for further evaluation and process standardization to achieve antimicrobial stewardship across the hospitals in our health system. There are significant opportunities for process standardization to achieve antimicrobial stewardship across our system. There are

significant opportunities for practice improvements in smaller hospitals, which may not have a structure for antimicrobial stewardship program.

Category: Infectious Diseases

Title: Pharmacist-driven inpatient influenza and pneumococcal vaccination program

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Purpose: Influenza and pneumococcal disease are significant causes of morbidity and mortality, despite the availability of safe and effective vaccines. At Saint Michael's Medical Center (SMMC), quality improvement reports reveal that rates for influenza and pneumococcal vaccination are suboptimal. The primary objective of this study is to assess the impact of a pharmacist on improving the rates of inpatient influenza and pneumococcal vaccination. Secondary objectives include measuring the vaccine administration time prior to discharge and evaluating the pharmacist's impact on decreasing vaccine refusals.

Methods: Patients from two cohorts were evaluated for the appropriateness of screening and administration of influenza and pneumococcal vaccines. A retrospective chart review was conducted on a cohort of patients and compared to a prospective evaluation conducted on a second cohort after initiation of the pharmacist-driven vaccination program. The program consisted of a pharmacist who screened patients and administered vaccines. SMMC policy instructs vaccination to be performed upon hospital discharge, yet the pharmacist was permitted to vaccinate patients at any time throughout hospital stay. Additionally, nurses were able to request vaccination by a pharmacist. Results were analyzed using descriptive statistics and the Fisher's exact test.

Results: A total of 50 patients were included, 25 in each arm. In the prospective group, 50% of those deemed eligible received the influenza vaccine compared to 21.4% in the retrospective group ($P=0.2365$). In the prospective group, 46.2% deemed eligible received the pneumococcal vaccine compared to 18.2% in the retrospective group ($P=0.2108$). Appropriateness of screening was assessed on 60 patients, 25 patients from each arm and 10 additional patients who were assessed by the pharmacist secondary to nursing request. Inappropriate screening by nursing occurred in 16.7% of patients. In total, the pharmacist screened 35 patients of which 15 received influenza vaccines and 14 received pneumococcal vaccines. Pharmacist-driven vaccination decreased vaccine refusal by 63% ($P=.0003$) and had an average vaccination time of 13.5 hours prior to discharge.

Conclusion: In this study, an increase in screening appropriateness and vaccine administration were observed as a result of the pharmacist-driven vaccination program. Pharmacist involvement within the hospital setting can improve vaccination rates and potentially help reduce the burden of vaccine-preventable diseases.

Category: Infectious Diseases

Title: Implementation of an outpatient antimicrobial stewardship program in a rural Veterans' healthcare setting

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Purpose: The Department of Veterans Affairs Black Hills Healthcare System (VA BHHCS) implemented an outpatient antimicrobial stewardship program for review of urine cultures. The quality improvement project was designed to improve patient care through evaluation of antibiotic usage and provision of pharmacist education with subsequent pharmacist intervention, as necessary. Secondly, patient outcomes were monitored and evaluated.

Methods: Prior to commencement, this quality improvement project was approved through the local pharmacy and therapeutics committee for implementation at VA BHHCS and presentation outside the VA. Retrospective chart reviews were done from February 2012 through March 2012 for all positive urine cultures obtained from the outpatient clinics. Education was provided to clinical pharmacists working in the Patient Aligned Care Team (PACT) clinic at the VA BHHCS Fort Meade campus on the appropriate treatment of urinary tract infections (UTIs). Culture reports were generated twice weekly from mid-February 2013 through mid-April 2013 from which outpatient urine cultures were reviewed. Following project implementation chart reviews were performed for all urine cultures reviewed by clinical pharmacists.

Results: Thirty cultures were reviewed pre-implementation and 25 cultures post-implementation from which 62 pathogens were isolated. Empiric therapy was appropriate in 20 out of 30 (67%) cultures pre-implementation versus 14 out of 25 (56%) cultures post-implementation. Following culture and sensitivity results, 28 out of 30 (93%) patients in the pre-implementation phase has appropriate therapy and the other two patients were changed to an appropriate antibiotic by the provider. Post-implementation 22 out of 25 (88%) of patients were receiving appropriate therapy with pharmacist review. Five recommendations were made by pharmacists regarding changes in antibiotic choice or dose, three of which were accepted by the provider.

Conclusion: In conclusion, it is apparent the primary care providers at VA BHHCS are appropriately treating UTIs in outpatients and that pharmacist involvement may not be necessary. Education of the most appropriate empiric treatment options for UTIs for providers and pharmacy staff will only lead to a further improvement in patient outcomes. In the future, pharmacists may be involved in guiding treatment for other outpatient infections.

Category: Infectious Diseases

Title: Impact of an antimicrobial stewardship at an 82 bed long-term acute care hospital (LTACH): one-year follow-up report

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Purpose: To optimize the appropriate use of antimicrobials and to prevent the emergence of antimicrobial resistance, an antimicrobial stewardship program (ASP) was implemented at an 82-bed Long Term Acute Care Hospital (LTACH) in June 2012 (1). The purpose of this study is to document the impact of an ASP including antimicrobial utilization and reducing healthcare costs over one year.

Methods: The antimicrobial stewardship committee consists of two infectious disease (ID) physicians and one ID pharmacist who developed a standard antimicrobial order form, made and presented an antibiogram, and constructed antimicrobial use policies which require physicians to de-escalate empiric therapy within 72 hours. The policy also restricts the use of the following antimicrobials and requires an infectious disease consult within 48 hours; aminoglycosides, ceftaroline, colistimethate, daptomycin, fidaxomicin, linezolid and tigecycline. The ID pharmacist reviewed all new antimicrobial orders and communicated with ID physicians on a daily basis for appropriate dosing, interval and de-escalation recommendations, and serum creatinine, peak and trough levels for three months. After this three month period, all pharmacists at the facility communicated ASP initiatives with ID physicians when needed. The facility's infection preventionist is also actively involved in ASP monitoring of Hospital Acquired Infection (HAI) rates and educating hospital staff on hand-hygiene. Patient days, medication cost, average length of stay, and the case mix index data were compared before and after implementing ASP. The data will be continuously collected until May 31, 2013 to compare twelve months before and after ASP implementation.

Results: The patient days (PDs) during the baseline period (from June 2011 to May 2012) were 22,228 with an average length of stay (ALOS) 27.71. During the period of June 2012 and April 2013, PDs were 19,828 with ALOS 27.24. ALOS decreased 2% after implementation of ASP. The case mix index (CMI) of the baseline and intervention periods were 1.285 each. Overall drug cost per patient-day decreased from \$78.14 to \$61.46 after ASP utilization (21% decrease). Antibiotic cost per patient-day decreased from \$40.60 to \$30.64 with ASP intervention (25% decrease), antifungal cost per patient-day went down from \$2.38 to \$1.42 (40% reduction) and antiviral cost per patient day lowered from \$4.07 to \$3.72 (9% decrease) after initiating this program. Most of the cost reduction was made from decreased use of linezolid (\$85,468

decrease), daptomycin (\$75,355 decrease), tigecycline (\$52,423 decrease) and carbapenems (\$52,925 decrease). The estimated cost savings from antimicrobials, antifungals and antiviral purchases after ASP implementation for 11 months was \$250,000.

Conclusion: ASP implementation at an 82-bed LTACH showed a reduction in the ALOS under the same CMI between the baseline and intervention period. It also showed a cost reduction in antimicrobials, antifungals and antivirals cost per patient day compared to the previous year without ASP interventions.

Category: Infectious Diseases

Title: Medication utilization evaluation on daptomycin after implementing antimicrobial stewardship program (ASP) at a small long-term acute care hospital (LTACH)

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Purpose: Medication utilization evaluation (MUE) on daptomycin was performed to evaluate the appropriate use and cost effectiveness of daptomycin after implementation of an Antimicrobial Stewardship Program (ASP) in a Long-term Acute Care Hospital (LTACH) setting.

Methods: The Antimicrobial Stewardship Committee (ASC) consists of two infectious disease (ID) physicians and one ID pharmacist. On June 1, 2012, the ASC developed an antimicrobial restriction policy; nine antimicrobials, one of which was daptomycin, were identified and placed on restricted use. These nine antimicrobials were restricted to ID approval after 72 hours of therapy. The use of daptomycin was evaluated three month before and three months after the implementation of ASP. The baseline period was between January 1, 2012 and March 31, 2012, and the intervention period was from January 1, 2013 to March 31, 2013. The variables studied in this MUE include patient days, indications for use, dosages, renal dosing adjustments, adverse events, culture and sensitivity reports, treatment outcomes, total number of patients who were treated with daptomycin and daptomycin cost per PD.

Results: PDs were 6,134 during the baseline period and 5,163 during the intervention period. Seventeen patients in the baseline and nine patients in the intervention group were treated with daptomycin during the study period. The study showed that seven out of seventeen patients (41%) in the baseline group and seven out of nine patients (78%) in the intervention group started treatment with daptomycin prior to being admitted to this institution. After implementing ASP, there was a 46% reduction in the numbers of patients per 1000 PDs who were treated with daptomycin (2.8 in 2012 vs. 1.7 in 2013). Among patients who were treated with daptomycin, 13 out of 17 patients (76%) in the baseline and 9 out of 9 patients (100%) in the intervention group received doses recommended for daptomycin. Culture and sensitivity were evaluated for 8 out of 17 patients (41%) in the baseline and 5 out of 9 patients (55 %) in the intervention group. All the patients who received daptomycin indicated successful treatment. Total purchasing cost for daptomycin was \$80,985 during the baseline and \$21,146 during the intervention period. Daptomycin cost per PD was decreased by 69% with ASP initiation (\$13.20 in 2012 vs. \$4.10 in 2013).

Conclusion: This study shows that ASP implementation at a small LTACH improved the use of daptomycin in appropriate dosing and checking culture and sensitivity. ASP initiation also reduced daptomycin use after admission to this facility which resulted in a dramatic decrease in daptomycin purchasing cost per patient-day.

Category: Infectious Diseases

Title: Impact of a pharmacy-driven antimicrobial stewardship program at a large community hospital after the implementation of computerized prescriber order entry (CPOE)

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Purpose: Antimicrobial stewardship programs are associated with improved clinical outcomes by reducing emergence of resistance, minimizing unintended consequences, and reducing drug costs. The Infectious Diseases Society of America (IDSA) and the Society for Healthcare Epidemiology of America (SHEA) provide recommendations to enhance antimicrobial stewardship. Numerous institutions have published strategies and experiences associated with their program. However, there is limited data regarding the integration of an antimicrobial stewardship program with the implementation of a Computer Physician Order Entry (CPOE) system. The purpose of our project is to establish a pharmacy-driven antimicrobial stewardship program with the new changes after the implementation of CPOE.

Methods: From September 2012 to April 2013, the pharmacy department led the development of a multidisciplinary antimicrobial stewardship team that consisted of physicians, nurses, microbiology, and infection control personnel. A clinical pharmacist was scheduled to work the antimicrobial stewardship (ASP) shift 40 hours a week Monday through Friday. This shift primarily focused on assessing all patients on antibiotics for greater than 3 days, streamlining and de-escalating therapy when appropriate, modifying drug therapy, assessing appropriateness for high cost antibiotics, and implementing the current IV to PO policy. The clinical pharmacy specialists were responsible for assessing antimicrobial therapy for patients in all the intensive care units (ICU) and an intermediate ICU step down unit 7 days a week. An infectious disease physician resource was available if needed. After the implementation of CPOE, the ability to communicate with physicians regarding antimicrobial therapy recommendations using written notes in the bedside chart was no longer feasible. All interventions had to be made with physicians either in person or by telephone. Clinical interventions recorded within this time period included the number of profiles reviewed, number of interventions made, intervention acceptance rate, and average day antibiotic therapy was discontinued.

Results: During this eight-month evaluation, 11,222 medication days were reviewed. A total of 1,055 interventions were made with 939 being accepted, yielding an average 89% acceptance rate. The most common recommendation category was discontinuation of antibiotic therapy. Estimated cost savings during this period was \$23,244, with an average of \$2,905 per month. Cost avoidance was estimated to be \$21,845. An expense analysis comparing antimicrobial purchases before and after the implementation of an antimicrobial stewardship program was

conducted. This analysis showed an 8% reduction, which amounted to an antibiotic spend difference of \$232,589 after the implementation of CPOE and the antimicrobial stewardship program.

Conclusion: Although the implementation of CPOE may pose new challenges, a pharmacy-led antimicrobial stewardship program can still provide improved clinical and financial impact.

Category: Infectious Diseases

Title: Experience with ceftaroline fosamil as monotherapy and combination therapy with vancomycin in acute bacterial skin and skin structure infections and community acquired bacterial pneumonia

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Purpose: Ceftaroline fosamil (CPT-F) is FDA approved for acute bacterial skin and skin structure infections and community acquired bacterial pneumonia. CAPTURE (Clinical Assessment Program and Teflaro Utilization Registry) is a multicenter retrospective cohort study describing patients treated with CPT-F for acute bacterial skin and skin structure infections (ABSSSI) and community-acquired bacterial pneumonia (CABP) in the United States. There is little information on the use of vancomycin plus ceftaroline for these infections. The experience in patients who received CPT-F monotherapy compared with patients who received combination therapy with vancomycin (VAN) for these infections is presented here.

Methods: Data were collected at participating centers by random selection and chart review of patients at least 18 years of age at time of treatment with CPT-F between August 2011 and February 2013 and included demographic information, disease characteristics, antibiotic use, and outcomes. The institutional review board at each site approved the protocol. Data collection did not occur until at least 30 days after last dose of CPT-F to ensure that all data was collected retrospectively. The evaluable population consisted of those who received at least 2 consecutive doses of CPT-F through August 2012 and at least 4 consecutive doses of CPT-F thereafter in addition to having a determination of a clinical outcome by the investigator.

Results: Of the 1030 patients treated for ABSSSI 54 percent were male; mean age 58.4 years (SD 17.7); mean body mass index 33.6 (SD 11.7). 645 received CPT-F monotherapy while 84 received CPT-F plus VAN; 274 patients on CPT-F monotherapy received prior VAN and 47 on CPT-F plus VAN received prior therapy with VAN. The mean CPT-F duration was 5.8 days (SD 4.8) and 6.8 (SD 6.8) on CPT-F plus VAN. ABSSSI clinical success on CPT-F was 86 percent and on CPT-F plus VAN, 85 percent. Of the 398 patients treated for CABP 50 percent of patients were male; mean age 63.5 years (SD 17.8) and 134 received CPT-F monotherapy while 41 CPT-F plus VAN; 53 patients on CPT-F monotherapy received prior VAN and 14 on CPT-F plus VAN received prior therapy with VAN. Co-morbidities were similar for those treated with CPT-F monotherapy and those treated with CPT-F plus VAN. Intensive care unit treatment occurred in 32 percent on CPT-F monotherapy and in 51 percent on CPT-F plus VAN. The mean CPT-F

duration was 6.4 days (SD 4.3) and 6.8 (SD 7.0) for CPT-F plus VAN. CABP clinical success on CPT-F was 78 percent and on CPT-F plus VAN, 73 percent.

Conclusion: Clinical success and duration of therapy were similar for CPT-F monotherapy and for CPT-F plus VAN for treatment of ABSSSI and CABP. The addition of vancomycin did not improve outcomes or shorten duration of therapy, supporting the use of CPT-F as monotherapy for the treatment of ABSSSI and CABP.

Category: Infectious Diseases

Title: Ceftaroline fosamil for treatment of acute bacterial skin and skin structure infections or community-acquired bacterial pneumonia in patients with renal insufficiency: CAPTURE study experience

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Purpose: Ceftaroline fosamil (CPT-F), a cephalosporin with broad spectrum activity was approved for the treatment of acute bacterial skin and skin structure infections (ABSSSI) and community-acquired bacterial pneumonia (CABP). CAPTURE (Clinical Assessment Program and Teflaro Utilization Registry) is a multicenter retrospective cohort study describing patients treated with CPT-F for these infections in the United States. Patients with renal insufficiency (RI) are thought to be at increased risk for complications in the setting of serious infections. Results for the subset with RI are presented.

Methods: Data were collected at participating centers by random selection and chart review of patients at least 18 years of age at time of treatment with CPT-F between September 2012 and February 2013 and included demographic information, disease characteristics, antibiotic use, and outcomes. The institutional review board at each site approved the protocol. Data collection did not occur until at least 30 days after last dose of CPT-F to ensure that all data was collected retrospectively. The evaluable population consisted of those who received at least 4 consecutive doses of CPT-F and had a clinical outcome determined by the Investigator. Clinical success was defined as clinical cure or clinical improvement plus a change to oral agents or discontinuation of all antibiotic therapy. RI was defined as serum creatinine > 1.8 mg/dL prior to the start of CPT-F.

Results: In the evaluable population 383 patients had ABSSSI and 126 patients had CABP; of these, 64/383 (17 percent) with ABSSSI and 26/126 (21 percent) with CABP had RI. Overall demographics include: 51/90 (57 percent) male; mean age 66.8 years (SD plus/minus 14.4, range 23 to 93); and mean body mass index 32.5 (SD plus/minus 10.3). The mean, median, and range of serum creatinine at start of CPT-F were 3.3, 2.8, and 1.8 to 9.1 in those with ABSSSI and were 3.3, 2.5, and 1.8 to 13.9 in those with CABP. Antibiotics were administered prior to CPT-F in 50/64 (78 percent) in those with ABSSSI and in 24/26 (92 percent) in those with CABP. The mean (plus/minus SD) duration of CPT-F therapy was 6.8 plus/minus 3.8 days for ABSSSI and 5.8 plus/minus 3.1 days for CABP. Concurrent antibiotic therapy was administered in 21/64 (33

percent) of ABSSSI patients and 17/26 (65 percent) of CABP patients. Clinical success rates for those with ABSSSI were 50/64 (78 percent) and for those with CABP were 21/26 (81 percent).

Conclusion: Clinical success with CPT-F was favorable in patients with ABSSSI or CABP with RI given considerable use of CPT-F as second-line therapy in most patients. These data support the use of CPT-F as a viable treatment option in patients with either ABSSSI or CABP with RI.

Category: Infectious Diseases

Title: The Assessment of Antimicrobial Stewardship Electronic Infrastructure Capabilities Within Washington State

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Purpose: Antimicrobial consumption metrics can be a useful tool when benchmarking overall utilization and monitoring of trends in prescribing patterns. Unfortunately, the optimal metric used to describe antimicrobial utilization rates is still under debate. The Medication-Associated Module in the CDC's National Healthcare Safety Network (NHSN) includes an AUR (Antimicrobial Use & Resistance) option. Only outbound electronic bar code medication administration (BCMA) or medication administration record (eMAR) data input is accepted. The purpose of this study was to identify the current use of selected medical informatics systems and describe metrics presently adopted within a statewide sample.

Methods: Pharmacy directors or representative clinical pharmacists (e.g. stewardship service pharmacists, clinical coordinators, etc) were contacted up to 6 times during the survey period. An announcement letter and survey was sent electronically in October 2012. In addition to the electronic reminders given via email, a follow-up mailing was performed 3 weeks after the initial electronic distribution of the survey. Pharmacists, with expertise in informatics or antimicrobial stewardship, and a research methodology expert developed and revised survey items. A 12-item survey instrument was created which contained two sections. The first section queried facilities regarding the presence and composition of an active antimicrobial stewardship service, the consumption metrics currently adopted, the frequency of metric evaluation, inter-facility benchmarking, and service-line level metrics. The second section of the instrument contained items regarding the current or anticipated implementation of medical informatics systems including, electronic health records (EHR), electronic medication administration records (eMAR), bar coding medication administration (BCMA) systems, and computerized antibiotic stewardship systems.

Results: Of the 109 Washington state hospitals surveyed, data was received from 45 facilities for a response rate of 41.3%. Of note, 34 of the respondents were from facilities of 100 beds representing 75.6% of hospitals of that size within the state. Stewardship programs, as defined as having one or more personnel participating in antimicrobial stewardship, were established in only 30.3% (n=33) of Washington State hospitals. Facilities of greater size represented a larger proportion of stewardship services when evaluated based on categorical facility size. Of hospitals with 200 beds, 63.0% (17 of 27) reported an active stewardship service. Antimicrobial

consumption monitoring by DOT per 1,000 patient days was observed to be less common among smaller hospitals <200 beds ($p=0.015$). Nearly all of the responding facilities reported use of an eMAR (100%) or BCMA (91.1%) systems. In contrast, only 56% (25 of 45) and 31% (16 of 41) respondents indicated an outbound HL7 interface for implemented eMAR and BCMA systems respectively. A third of reporting facilities indicated that they did not evaluate antimicrobial consumption. Only a small proportion (24.4%) reported use of the DOT per 1000 patient day metric.

Conclusion: A large variation was observed in the methodology of antimicrobial consumption measures within the sample group. This is likely due to the lack of consensus to which metrics provide meaningful information. Another factor is the informatics resource constraints within facilities resulting in the widespread variance in methods used. Although the current informatics infrastructure makes it unlikely that facilities currently have the resources to independently participate with the NHSN AUR option, the potential for a large-scale benchmarking system does exist.

Category: Infectious Diseases

Title: Evaluating the acceptance of anti-retroviral interventions in a large metropolitan hospital

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Purpose: Antimicrobial stewardship programs continue to gain acceptance in hospitals as a way to optimize antibiotic use, prevent antimicrobial resistance, and optimize cost. Due to unfamiliarity with multi-drug HIV therapies, resident physicians and pharmacists may miss inappropriate dosing, drug-drug interactions, and inappropriate regimens. The use of such a program to improve anti-retroviral use is less well established. In this study we evaluate the use of such an anti-retroviral stewardship program employing a clinical pharmacist at a tertiary care, academic hospital in New York City.

Methods: In July 2011 a formal stewardship program to review anti-retroviral medications was initiated. An infectious disease trained clinical pharmacist (part of the antimicrobial stewardship team), reviews all patients on anti-retrovirals on scheduled days. If inappropriate therapy, incorrect dosing, or drug-drug interactions are identified, the resident physicians are notified via pop-up email or phone. If required, therapy is clarified with an infectious disease attending physician prior to contacting the team. Emails are followed by phone calls when necessary. Interventions are then entered daily using the hospitals electronic healthcare record/computerized physician order entry system (QuadraMed) by the clinical pharmacist. Acceptance of stewardship suggestions is recorded. The number of interventions performed, the rate of acceptance of the interventions, and the types of anti-retroviral medication requiring interventions were evaluated prior to and post introduction of the program

Results: After implementation of the formal anti-retroviral stewardship program the number of interventions pertaining to anti-retroviral therapy rose two to three-fold (range 200% to 267%). Greater than 20% (range 16% to 27%) of all patients on anti-retroviral therapy required an anti-retroviral intervention by the clinical pharmacist. The intervention acceptance rate ranged from 92% to 96%. The anti-retrovirals requiring the most frequent interventions are: ritonavir (30%), atazanavir (14%), lamivudine (12%), others (10%), tenofovir (7%), tenofovir-emtricitabine (7%), darunavir (7%), zidovudine (4%), ritonavir-lopinavir (3%), raltegravir (3%), and emtricitabine (3%).

Conclusion: Daily review of anti-retrovirals at a large metropolitan hospital resulted in an increased number of interventions and ensured the appropriate use of these agents. One in five patients required an intervention by the clinical pharmacist. The changes recommended by the

clinical pharmacist were accepted more than 90% of the time. The anti-retroviral medication that required the most interventions to modify therapy has been ritonavir.

Category: Infectious Diseases

Title: Improving appropriate utilization of empiric broad-spectrum antibiotics through educational efforts

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Purpose: The primary goal of an antimicrobial stewardship program (ASP) is to optimize clinical outcomes and minimize adverse consequences associated with antimicrobial usage. Supplements to improve broad-spectrum antibiotic (BSA) utilization include education and guidelines. The purpose of this study was to measure the effects of education and implementation of clinical guidelines outlining utilization criteria to improve the appropriate initiation of BSA on day 1, time 0.

Methods: This was an institutional review board exempt, observational cohort study conducted from February to April 2013. The patient population included all adult patients receiving at least one dose of cefepime, piperacillin/tazobactam, and imipenem/cilastatin were included. Patients were excluded if they were admitted to pediatrics, maternity, or neonatology. Education was provided to the medical residents during noon conference on the appropriate clinical criteria that warrants use of BSA and empiric treatment for various infectious diseases. A total of 50 patients initiated on target BSA agents were identified using a clinical monitoring queue developed in the hospitals electronic patient record system. Two study cohorts were analyzed: medical residents (group A; n equals 18) and all other hospital prescribers (group B; n equals 32). The primary endpoint was the proportion of patients that met the established criteria for initiation of BSA. Secondary endpoints included duration of BSA therapy, percentage of patient de-escalated from BSA therapy, and percentage of patients converted from parenteral to oral antibiotic therapy.

Results: The primary endpoint showed 94 percent of patients in group A met the predefined criteria for initiation of BSA in comparison to 84 percent of patients in group B (P equals 0.39). Subgroup analysis comparing group A with hospitalist subgroup showed 38 percent of hospitalists met the criteria for use of BSA compared to 94 percent of medical residents (P equals 0.0045). There was no statistically significant difference between the study cohorts in duration of BSA therapy (P equals 0.64) and percentage of patients converted from parenteral to oral therapy (P equals 0.49). There was a significant difference in the percentage between group A and group B for patients de-escalated on BSA therapy (77 percent and 43 percent, respectively; P equals 0.01).

Conclusion: Education for medical residents did not improve BSA utilization compared to all other hospital prescribers but did show improve compared to non-specialty prescribers. Clinical significance for improving ASP initiatives requires long-term prospective research.

Category: Infectious Diseases

Title: The Rhode Island Antimicrobial Stewardship Task Force (RIASTF): advancing antimicrobial stewardship efforts through state-wide collaboration

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Purpose: In 2011, the president of the Rhode Island Society of Health System Pharmacists issued a call to action to advance the states antimicrobial stewardship (AMS) efforts. One pharmacist from each of the states 12 major hospitals was identified to collaborate and assist in developing local multidisciplinary antimicrobial stewardship programs (ASP). The mission of this group, entitled the Rhode Island Antimicrobial Stewardship Task Force (RIASTF), was to lead national efforts in reducing antimicrobial-resistant hospital-associated infections and improve patient care through collaboration among all acute care institutions in the state. This abstract describes the development and activities of the RIASTF.

Methods: RIASTF members participate in monthly leader-facilitated meetings that have both an educational and collaborative component. Formal minutes are kept for each meeting. In September 2011, a member needs assessment survey was given to identify real and perceived gaps in the groups infectious diseases (ID)/AMS knowledge and skills. This information was used to tailor the educational curriculum of meetings. Members regularly lend their expertise as instructors to support this curriculum. In addition, the RIASTF Tip of the Week, a short, timely item describing basic AMS or ID practice, is published by the group to the hospital pharmacy staffs and other interested parties. A listserve and cloud based information portal have been established. Policies, protocols, data collection forms and metrics are shared by members. Reports on RI AMS initiatives and advancements have been given at the state Quality Improvement Organization meetings. The progress of AMS efforts in the state since the inception of the RIASTF is being assessed.

Results: Infectious diseases/AMS experience of members range from formal training (i.e. ID PGY-2 residency or fellowship) to no training. Attendance at monthly meetings averages 68.5% (range; 50-100%). Many facets of AMS were of interest. Improving patient outcomes and decreasing bacterial resistance rates were identified as highest priority goals in establishing AMS by more than 80% of respondents. When asked about institutional needs, more than 80% of respondents felt that local clinical guidelines and educational tools were a high priority and 100% indicated that knowledge of clinical practice guidelines was of moderate or high importance. Similarly, more than 80% felt that an examination of antimicrobial resistance and carbapenem use was a priority. Tracking resistance patterns and antimicrobial use were desired

outcomes measures for more than 80% of respondents. All respondents felt that length of stay/mortality data were needed to justify their AMS service. Based on this survey, curriculum offerings have included discussions on clinical practice guidelines, Gram-negative resistance, measures and metrics, credentialing, briefings on various ID society meetings, topical literature reviews, journal club discussions and best practice descriptions. Small community and/or resource limited hospitals have described benefit from collaboration with ID pharmacy specialist members from other institutions.

Conclusion: The RIASTF, a formal state-wide pharmacy collaborative, was established to advance AMS in the state. By developing model procedures and policies, providing educational materials, and facilitating open communication between members, the RIASTF has increased member awareness and knowledge of AMS and has promoted the expansion of AMS in the state of RI. The RIASTF may be a model for successful antimicrobial stewardship advancement that could be adopted by other states or regions.

Category: Infectious Diseases

Title: Implementation of a proactive computerized physician order entry antibiotic stewardship program and its impact on linezolid use in a community hospital: three-year follow-up analysis

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Purpose: To assess the use of linezolid three years after the implementation of a proactive, computerized physician order entry antibiotic stewardship program (CPOE-ASP) in a community hospital.

Methods: A CPOE-ASP was designed for a 214 bed community hospital in which linezolid ordering is guided via on-screen, clinical decision support tool for providers. Based on Pharmacy & Therapeutics Committee recommendations, approved indications for linezolid are limited to: 1) treatment failure of at least 5 days of vancomycin treatment, 2) vancomycin-resistant enterococcus; 3) history of allergic reaction to vancomycin and 4) recommendations of alternative antibiotics along with hyperlinks to evidence-based articles. Linezolid use for bacteremia, endocarditis and osteomyelitis is considered inappropriate unless all other treatment options have been unsuccessful. Use was prospectively monitored using monthly hospital pharmacy purchasing data to obtain the defined daily dose (DDD) per 1000 patient-days. A medication utilization evaluation (MUE) was performed to assess the appropriateness of linezolid ordering.

Results: The number of orders placed for linezolid and the percentage of appropriate orders in the four months prior to implementing CPOE-ASP were 168 (mean 42 per month) and 18.9 respectively. In the four months following implementation, the number of linezolid orders decreased to 53 (mean 13.3 per month), while the percentage of appropriate orders increased to 92.4 ($p < 0.0001$). In the three years following implementation, the total orders placed for linezolid were 483 (mean 13.4 per month), and the percentage of appropriate orders, during a random four-month period MUE was 81.5%. Moreover, within one year upon the introduction of the CPOE-ASP, linezolid use significantly decreased from 28 DDD/1000 patients day to 7.5 DDD/1000 patient days ($p < 0.0001$). In the three years following implementation, the use of linezolid remained at 7.4 DDD/1000 patient days ($p < 0.0001$). Hospital expenditures for linezolid decreased, resulting in cost savings of over \$600,000 over a 16-month period.

Conclusion: A proactive, CPOE-ASP can have a positive impact on antimicrobial prescribing by hospital practitioners that is sustainable over time.

Category: Infectious Diseases

Title: Survey of hospital pharmacists regarding vancomycin dosing protocols in obese patients

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Purpose: Current vancomycin dosage recommendations, as given by the 2009 vancomycin consensus statement, suggest initial vancomycin dosing be based on actual body weight (ABW). At the present time, dosing data are very limited for obese patients. Some institutions have developed dosing parameters for obese patients and have initiated dosing protocols based on an adjusted body weight. However, these recommendations are not clearly defined and are highly variable between institutions. We surveyed pharmacists from various institutions to evaluate vancomycin dosing in obese patients.

Methods: An anonymous online survey was posted to the American Society of Health-Systems Pharmacists (ASHP) inpatient care and clinical specialist sections, and emailed to members of the Society of Infectious Disease Pharmacists (SIDP). Respondents were asked to provide institution specific information regarding dosing of vancomycin in obese patients. Survey items included: 1) specific recommendations used to dose vancomycin in obese patients, 2) parameters for initial empiric dosing (actual, ideal or adjusted body weight), 3) utilization of loading doses, 4) use of maximum single and daily doses 5) attainment of steady state trough concentrations when compared to non-obese patients, and 6) incidence of vancomycin associated nephrotoxicity in obese patients. All respondents were encouraged to forward their institution specific vancomycin nomograms for obese patients. The survey was available in May 2013 for a two week period. Institutional review board (IRB) approval was not required.

Results: One hundred and sixteen surveys were completed and analyzed. Forty-nine percent surveyed stated their institutions have vancomycin dosing protocols for all patients, 35 percent per physician referral and 13 percent have no protocol. Sixty-five percent of respondents have specific recommendations for obese patients; however, definitions varied and were defined either by body mass index, a defined percentage above ideal body weight or a specified weight (ex: greater than 150 kg). In regards to initial empiric dosing, 48 percent surveyed use actual body weight compared to 36 percent for adjusted body weight. Sixty-five percent use loading doses with some respondents stating it is optional and reserved for specific indications (bacteremia, meningitis). A majority (76 percent) indicated their institutions define maximum single and daily vancomycin doses. However, recommendations varied with maximum single doses ranging from 1.5 to 4 grams and maximum daily doses ranging from 3 to 8 grams. When compared to non-obese patients, 49 percent of obese patients first steady state trough concentrations tend to be sub-therapeutic (37 percent) or supra-therapeutic (12 percent). Only 18 percent of respondents

believed vancomycin associated nephrotoxicity occurred more in obese patients; however, 33 percent were unsure if nephrotoxicity was increased when compared to non-obese patients.

Conclusion: As illustrated by survey results, optimal dosing of vancomycin in obese patients is not well defined. Sixty-five percent of respondents have specific dosing recommendations for obese patients; however, definitions for obesity, dosing weight, and maximum single and daily doses varied between institutions. Accordingly, approximately half of obese patients do not reach initial therapeutic steady state trough concentrations when compared to non-obese patients. A limited number of respondents stated that nephrotoxicity occurred more in the obese population. Currently, based on survey results, vancomycin dosing in the obese population is highly variable among institutions.

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Category: Infectious Diseases

Title: Breakthrough fungemia in a patient receiving posaconazole: the case of the missing fat

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Purpose:

Methods:

Results:

Conclusion:

Category: Infectious Diseases

Title: Promotion of rational use of antimicrobial by clinical pharmacist in an infectious diseases infirmary of a general large tertiary teaching hospital, Sao Paulo, Brazil

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Purpose: Prompt antimicrobial therapy for an infected patient can make the difference between cure and death or long-term disability. To optimize antimicrobial use by minimizing exposure to drugs, dose adjust, reduce redundant therapy, and target therapy to the likely pathogens is viewed as a strategy to enhance patient safety, beyond reducing pharmacy expenditures reduce, is an important benefit to health care system nowadays. The purpose of this study is to evaluate the frequency of pharmacist interventions related to the rational use of antimicrobial together with the nursing team of the infectious and parasitic diseases infirmary.

Methods: A descriptive and retrospective study, conducted between January and December 2012, at the Division of Infectious and Parasitic Infirmary Diseases, with 33 beds for care of patients with high complexity infectious diseases of a, Large Tertiary Teaching Hospital in So Paulo, Brazil. The data were collected from the institutional Table of Pharmaceutical Intervention, prescriptions evaluation and pharmacist interventions for the antimicrobials rational use performed by the clinical pharmacist. A Excel 2007 spread sheet was used to classify the interventions related to drug interactions; dosage; indication; route of administration; standard medication chart; prevention of adverse events; other interventions; guidance to the multidisciplinary team and reported adverse drug events. Descriptive statistical analysis was applied, with emphasis on percentage.

Results: A total of 5012 prescriptions from 459 inpatients were analyzed, resulting in 1112 pharmacist interventions, of which 327 (29,4%) for the rational use of antimicrobials and 294 (89,4%) being accepted. From those 294 accepted, 165 (56,1%) were about drug interactions; 60 (20,4%) dosage; 29 (9,9%) indications; 22 (7,5%) route of administration; 15 (5,1%) to other interventions; 2 (0,7%) standard medication chart and 1(0,3%) to prevention of adverse events. Were performed 11 guidance for the multidisciplinary team and observed 31 adverse events: 26 adverse drug reactions; 03 (9,7%) allergies and 02 medication errors, related to antimicrobials. Some pharmacist interventions were performed more than one time: (55) until some typing error in the electronic prescription system be corrected; from all 33 not accepted interventions, 20

(60,6%) were accept only when the intervention was done by the second time, resulting in only 13 interventions definitively not accepted.

Conclusion: It was evidenced by the percentage of pharmaceutical interventions that the pharmacist had an important contribution for improve patient safety, maximizing the therapeutic effect, by drug interactions, dosage adjustments for specific groups and subdose and overdose reduction, promoting the rational use of antimicrobials with the multidisciplinary team of health nursing.

Category: Infectious Diseases

Title: Evaluation of a vancomycin dosing nomogram in a community hospital

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Purpose: A vancomycin dosing nomogram and monitoring form was created to simplify empiric doses and streamline monitoring procedures. The dosing nomogram estimates an empiric vancomycin regimen based on body weight and an estimated creatinine clearance when the value is greater than or equal to 30 milliliters per minute. The purpose of this study was to evaluate the effectiveness of the nomogram in achieving initial vancomycin serum trough concentrations within 10 to 20 mg/L in adult patients in a community hospital.

Methods: The institutional review board approved this retrospective chart review. Patients were included if vancomycin was dosed correctly using the nomogram and if an initial trough was drawn. Patients were excluded if vancomycin was not dosed using the nomogram, weighed less than 40 kg, had an estimated creatinine clearance less than 30 milliliters per minute, had a vancomycin trough level trough drawn before the fourth dose, or were receiving dialysis or continuous renal replacement therapy. The primary outcome was the percentage of patients who achieved an initial serum trough concentration within 10 to 20 mg/L. Secondary outcomes included calculating the mean and median prediction error and the mean and median percent prediction error for the vancomycin trough concentrations, mean and median initial trough concentration, and the incidence of nephrotoxicity. The Abbottbase Bayesian Pharmacokinetic Systems software was utilized to calculate a predicted serum trough concentration for each patient. The prediction error was calculated for each patient using the actual and predicted serum trough concentration. The use of the T statistic 95 percent confidence interval was used to determine the differences between the predicted and actual serum trough concentrations.

Results: A total of 89 patients met criteria for chart review and analysis. The average length of vancomycin therapy was 5 days plus or minus 1.99 days. The most common indications for vancomycin were pneumonia and cellulitis. Sixty five percent (58/89) of patients achieved an initial serum trough concentration within 10 to 20 mg/L and 79 percent (70/89) of patients achieved an initial serum trough concentration within 9 to 21 mg/L. The mean initial serum trough concentration was 14.16 mg/L (95 percent CI 13.17 to 15.15) and the median concentration was 14 mg/L (IQR 10.4 to 17.4). The mean prediction error was 5.68 (95 percent CI 3.87 to 7.51) and the median prediction error was 4.33 (IQR 0.18 to 10.26). The mean percent prediction error was 16.3 percent (95 percent CI 8.23 to 24.32) and the median percent prediction

error was 26.52 percent (IQR 1.23 to 44.37). The incidence of nephrotoxicity was 9 percent (8/89).

Conclusion: Sixty five percent of patients achieved an initial vancomycin trough within the range of 10 to 20 mg/L and almost eighty percent of patients were within the range of 9 to 21 mg/L using a vancomycin dosing nomogram. Interpreting the 95 percent CI, the vancomycin nomogram produced serum trough concentrations that fit between confidence limits of 13 to 15 mg/L. Utilization of a loading dose may increase the percentage of patients within the target trough range. Daily evaluation for vancomycin therapy discontinuation and minimizing concomitant nephrotoxic agents may impact the occurrence of nephrotoxicity.

Category: Infectious Diseases

Title: Pharmacy driven antimicrobial streamlining: Effects on antimicrobial use in defined daily doses per 1000 patient days.

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Purpose: Antimicrobial overuse drives resistance, promotes opportunistic infections such as clostridium difficile and acinetobacter, lengthens hospital stays, and increases overall costs . At our 175 bed inpatient urban hospital we are experiencing all of these negative effects, including the advent of carbapenem resistant enterobacteriaceae and high MIC MRSA that is difficult to treat with vancomycin. Our efforts to establish a more traditional stewardship program with an ID practitioner at the helm met with obstacles, particularly financial. In its place we have incrementally increased pharmacy antimicrobial oversight with the goal of decreasing overall usage.

Methods: Our hospital has had basic antimicrobial stewardship in place for a number of years: Dose optimization, IV to oral conversions, and formulary restriction. In September 2012 the program was strengthened, with clinical education for all pharmacists, rotation through clinical and staff shifts, and an expanded stewardship program to include antibiotic streamlining. This begins with assessment of antimicrobials at 72 hours to assess whether they are appropriate and/or needed. If intervention is necessary, the clinical pharmacist calls the practitioner or leaves a note in the chart. Tools made available to the pharmacist include 1) Education: Stewardship courses and meetings, the hospital antibiogram, and an array of references. 2) An antimicrobial policy, including specific criteria for escalation of therapy to last resort agents 3) An antimicrobial use communication sheet that includes the criteria for clinical stability. 4) A physician communication sheet to leave in the chart for the prescriber. The total number of stewardship interventions was tracked. This included reviewing cultures, contacting the ID physician, and asking to narrow therapy with either a phone call or a note. Stewardship outcomes were assessed for total antimicrobial use, linezolid and daptomycin as defined daily doses (DDD) per 1000 patient days (PD).

Results: The pharmacy averaged 50 antimicrobial interventions per month from September 2012 to April 2013 including chart reviews and interventions (Intervention data not available before intervention, March data excluded due to computer issues). Our antimicrobial use follows strong seasonal trends, so the months were grouped for comparison. The data for January to April 2012 (before intervention) was compared to the data for January to April 2013 (after intervention). The mean total antimicrobial use for Jan-Apr 2012 was 2042 DDD/PD (SD 108) as compared to 1531 DDD/PD (SD 529) for Jan-Apr 2013; there was no statistical difference, $P=0.11$. The daptomycin use was unchanged, Jan-Apr 2012 mean 151 DDD/PD (SD 34) as compared to 127 DDD/PD for Jan-Apr 2013 (SD 57), $P=0.49$. The linezolid use was significantly reduced, with 47 DDD/PD (SD 15) for Jan-Apr 2012 as compared to 22 DDD/PD (SD 7) for Jan-Apr 2013, $P=0.03$. There are many possible confounders to the data, including that the patient acuity may

have changed. One of our two daptomycin prescribers (infectious disease) has increased many of their orders to 10 mg/kg over the same time period as the intervention, and the defined daily dose has not changed.

Conclusion: Our antimicrobial stewardship program affects outcomes both directly, by intervening on specific patient cases, and indirectly, by increasing prescriber awareness of our antimicrobial overuse and the potential for negative outcomes. Our hospital's use of linezolid has decreased, and this may be due to our efforts. The daptomycin use has not changed, but this result is complicated as previously mentioned. The total antimicrobial use has not changed, but we are hoping to see a statistical difference as the year continues and more data is available for comparison.

Category: Infectious Diseases

Title: The Economic Burden of Clostridium difficile-Associated Disease in Selected Populations: A Retrospective Study of Acute Care Hospital Inpatients, 2009-2011

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Purpose: Evaluate the economic burden and selected clinical outcomes in specific patient populations with Clostridium difficile-associated disease (CDAD) compared to a similar populations without CDAD.

Methods: Inpatients ≥ 18 years, discharged between 2009 and 2011 with a CDAD diagnosis (ICD-9-CM code 008.45) and also receiving CDAD treatment (vancomycin, fidaxomicin or metronidazole) during hospitalization, were selected from the Premier research database. Non-CDAD patients were chosen using an exact match on MS-DRG and year of discharge, and propensity score-based matching on relevant patient characteristics. Patients with missing or incomplete cost data in each group were excluded from the analysis. CDAD and non-CDAD patients at high risk of recurrence, (i.e., those with renal impairment (RI), malignant neoplasms (MALIG), immunocompromised status (IMMUN), inflammatory bowel disease (IBD), and concomitant antibiotic use (ABX)) were compared for differences in total and ICU length of stay (LOS) in days (d), total hospital costs, and rate of all cause readmissions occurring within 30 and 60 days after discharge. Multivariate models were employed to further adjust for differences remaining after the matching process.

Results: Models adjusting for patient characteristics identified differences in hospital and ICU LOS and total costs for index event that were significantly greater for all CDAD vs. non-CDAD populations. Values for hospital LOS were: RI:14.5d vs. 9.4d; MALIG:13.6d vs. 8.9d; IMMUN:17.8d vs. 12.0d; IBD:10.4d vs. 6.9d, and ABX:15.5d vs. 9.9d; all $p < 0.001$. Differences in ICU LOS followed similar patterns to overall LOS: RI:10.3d vs. 8.5d; MALIG:4.7d vs. 3.7d; IMMUN:6.6d vs. 5.5d; IBD:7.8 vs. 6.1, and ABX:5.2d vs. 4.3d; all $p < 0.001$. Incremental hospital expenditures for cases vs. controls for all subgroups were also significantly elevated, with differences ranging from +\$5,527 to +\$9,453. Subgroup-specific values were: RI:\$31,263 vs. \$22,321; MALIG:\$24,694 vs. \$17,713; IMMUN:\$33,064 vs. \$24,372; IBD:\$19,667 vs. \$14,141, and ABX:\$31,480 vs. \$22,026; all $p < 0.001$. Additionally, 30 day all cause readmission rates were greater for all CDAD vs. non-CDAD patients: RI:25.0% vs. 16.6%; MALIG:46.8% vs. 28.9%; IMMUN:30.4% vs. 23.7%; IBD:21.0% vs. 15.6%; ABX:23.1% vs. 14.5%; all $p < 0.0001$. Adjusted odds ratios (with 95% confidence intervals) accounting for any post-match residual confounding further supported these results: RI:1.66 (1.59-1.73); MALIG:1.45 (1.36-

1.56); IMMUN:1.45 (1.30-1.62); IBD:1.33 (1.12-1.59); ABX:1.72 (1.66-1.79). Similar outcomes were seen for 60 day readmissions.

Conclusion: CDAD patients with underlying conditions or characteristics known to be associated with increased risk of recurrence showed significant increases in hospital and ICU LOS, total costs, and risk of 30 and 60 day all cause readmissions when compared with similar non-CDAD patients. Greater focus on reducing recurrences and potential subsequent readmissions among patients at high risk of recurrence is warranted.

Category: Infectious Diseases

Title: Effects of early switching from intravenous to oral antibiotics on the outcomes of patients with bacteremia secondary to urinary tract infections

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Purpose: Urinary tract infection (UTI) with gram-negative bacilli is common and bacteremia (with the same causative pathogen in blood cultures) complicating this infection is frequently seen. Duration of antimicrobial therapy for bacteremic patients is usually 14 days. In these cases, clinicians often prefer the parenteral route of administration. Early intravenous (IV) to oral switch has been shown to reduce risks of line infection, length of stay in hospitals as well as increase comfort level and mobility of patients. This project aims to evaluate the clinical outcomes of early switching from IV to oral antibiotics in patients with bacteremia secondary to UTI.

Methods: Medical records of patients with bacteremia secondary to UTI were identified from the Antimicrobial Stewardship Programme (ASP) database and reviewed. Early switching in this study was defined as time to switch to oral antibiotics within the first seven days of treatment. Mann-Whitney U test was used to evaluate the length of stay between the two groups and chi-squared test to evaluate the odds ratio of clinical complications and 30-day readmission in these groups.

Results: 98 patients with bacteremia secondary to UTI were identified. Early switching in bacteremia secondary to UTI patients was shown to have significantly shorter duration of stay (median: 6 days versus 12 days) in hospital ($p < 0.01$). Odds ratio for clinical complications in early switch group was 1.58 (95% CI 0.30 8.28), and for 30-day readmission was 0.75 (95% CI 0.12-4.72). They were both insignificant with $p = 0.714$, and $p = 0.759$ respectively.

Conclusion: Early switching from IV to oral antibiotics has advantages in terms of length of stay. It does not however, confer benefits or disadvantages in terms of clinical complications. Evaluation on more variables such as mortality and monetary costs may be needed in a larger population group.

Category: Infectious Diseases

Title: Candida spp. isolate review and impact on prescribing preferences in a community teaching hospital

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Purpose: Many institutions experienced an increase in antifungal utilization and overall drug budget with the introduction of the echinocandin antifungals in early 2000. Increased use of the echinocandins and other broad-spectrum antifungals may be attributed to several factors including side-effects, drug-interactions, clinical perception, and an increase in non-albicans Candida species. In an effort to help guide prescribing practices we reviewed our Candida spp isolates to identify any patterns and their sites of infection; and then followed the impact that this data had on broad-spectrum antifungal utilization at our institution.

Methods: Data from our microbiology department was collected and reviewed for all positive Candida spp cultures that were identified January 1st 2008- December 2008. Data collected included species (Candida albicans, Candida glabrata, Candida tropicalis, Candida parapsilosis, and Candida krusei), source (clarified to 1 of 4 collection sites: Blood, Wound, Airway, and Urine), and calendar date that the isolate was collected and identified. The data was entered into a Microsoft Excel spreadsheet for analysis. Purchasing data was collected retrospectively from the review, and the numbers reflect annual expenditure and echinocandin equivalent doses to estimate drug utilization trends. A time frame of three years pre- and post- presentation of the results was used to identify impact on overall drug usage trends.

Results: Data collected from 2008 yielded a total of 382 Candida spp. isolates. Ninety-three percent were Candida albicans, which accounted for ninety percent of the isolates identified in wound, airway and urine sources. Candida glabrata was the second most common species identified overall, and represented approximately four percent of total isolates. Review of our blood culture isolates yielded a different breakdown where Candida glabrata was identified more often than Candida albicans; Candida glabrata accounted for forty percent of candidemias. The following data was presented to our Infectious Disease physicians and our purchasing trends were reviewed for three years pre and post presentation of the data. Prior to the review, our annual antifungal purchasing expenditure was approximately \$86,000. Post review, our average annual antifungal purchasing expenditure decreased to \$59,000. We also saw a decrease in our average echinocandin expenditure, with an average of 45 days less of therapy ordered annually.

Conclusion: Institutional review of Candida spp organisms revealed that Candida albicans was the predominant species of yeast found in the majority of our patient population regardless of culture-site, with the exception of candidemia where Candida glabrata was identified as a predominant pathogen. Utilization of this data has led to improved prescribing of empiric antifungals and limited our use of broad spectrum agents to candidemias, critically ill patients, and patients refractory to conventional treatments. Improvement in prescribing practice can be

attributed to the institution-specific data, daily reviews by clinical pharmacists, and physician attitude in appropriate drug use. These factors combined have led to a dramatic decrease in broad-spectrum agent use and our annual expenditure for antifungal agents.

Category: Infectious Diseases

Title: Evaluation and implementation of systems to improve the care of patients with severe sepsis and septic shock

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Purpose: A multidisciplinary best practice workgroup was convened to evaluate the care of patients with severe sepsis and septic shock at a large tertiary care medical center. The goal of the workgroup was to identify areas for improvement in the care of patients with sepsis and develop strategies to improve the treatment of sepsis, severe sepsis, and septic shock.

Methods: The workgroup first reviewed the literature to determine evidence-based best practices and guidelines to guide the care of patients with severe sepsis and septic shock. Since time to antimicrobial administration has been found to be a key factor in outcomes for patients with septic shock, baseline data was collected to assess antimicrobial turn-around time. Additionally, there were continual assessments of current processes to identify possible system improvements that may affect time to antimicrobial administration.

Results: The assessment of baseline data and system processes demonstrated a need to improve the time to antimicrobial administration in patients with severe sepsis and septic shock. In order to address this, an order set was initially created to help guide the provider in appropriate management of this patient population. After the implementation of computerized physician order entry, the change in workflow for bedside clinicians led the workgroup to investigate other possible system changes. A new drug administration system was implemented and critical broad spectrum antibiotics were moved to automated dispensing cabinets. Finally, a clinical decision support tool was added to the electronic medical record to alert nursing staff of new antibiotic orders.

Conclusion: The care of patients with severe sepsis and septic shock is complex and requires many critical and timely interventions, one of which is the prompt administration of effective antimicrobial therapy. In a large tertiary care center, a best practice workgroup implemented multifaceted solutions to improve time to antimicrobial administration and care of these patients. Successful implementation of the system changes required multidisciplinary support and education of healthcare providers.

Category: Leadership

Title: Creation of a pharmacy administration longitudinal rotation for postgraduate year (PGY) 1 residents

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Purpose: In the 2012-2013 academic year our organization trained five Postgraduate Year (PGY) 1 Residents and one PGY 2 Critical Care Resident. The residency program previously included a one month pharmacy administration rotation which was designed to give a brief overview of pharmacy administration topics for the PGY 1 residents, but was not a particularly robust or diverse experience. Past residents identified this rotation experience as one that could be improved upon for future residents, incorporating more leadership and administration topics in a more structured fashion.

Methods: A longitudinal rotation experience was designed, based on the American Society of Health-System Pharmacists (ASHP) Foundations Pharmacy Leadership Academy (PLA) syllabus. Each month of the 12 month experience was designed with a primary focus area, such as leadership development and principles of leadership, an overview of financial metrics, a review of quality improvement initiatives, a regulatory and compliance overview, and introduction to human resource topics. Each of the focus areas was further supported by monthly reading assignments, a project or activity and a topic discussion that were tied to specific residency learning system (RLS) goals and outcomes. The RLS goals identified to be addressed with this learning goals include: (R1.1) Identify opportunities for improvement of the organizations medication use system; (R1.2) design and implement quality improvement changes to the organizations medication use system; (R3.1) exhibit essential personal skills of a practice leader; (R3.2) contribute to departmental leadership and management activities; (R3.3) identify opportunities for improvement of the organizations medication use system.

Results: The 12 month experience was completed by all five PGY 1 residents. Our PGY 2 resident and the longitudinal Advance Practice Education Experience (APPE) students attended activities as their schedule allowed. Projects and activities completed by the residents during this experience include the creation of a personal mission and vision statement, Whitney award winner discussion, Pharmacy Practice Model Initiative (PPMI) self-assessment review, interview role playing, resident job description review and updates, residency policy review, budget planning and business proposal review.

Conclusion: The changes to the learning experience resulted in a more robust review of pharmacy administration topics and an opportunity to discuss personal leadership goals and

principles. The learning activities and reading assignments more effectively support the goals and objectives and provided more structure to the learning experience.

Category: Leadership

Title: Evaluation of daily medication exchange and impact on workflow

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Purpose: While there are advantages to storing patient-specific medications in automated dispensing cabinets, a variety of obstacles may prohibit the use of this technology. A daily medication exchange remains a common procedure for dispensing medications for the next 24 hours. This project was designed to find an easier, more efficient and flexible way for pharmacy technicians to fill, pharmacists to check, and for technicians to deliver daily medications to patients at a community hospital.

Methods: Pharmacy staff worked together to design and evaluate three different methods of filling, checking, and delivering daily medications. The first and original method used a large cart to fill, check, and deliver patient specific bins to nurses' workstations on wheels (WOW), where nurses were responsible for moving their WOW to a designated area at a specific time. The second method used the large cart to fill each patient's medications in the patient-specific bin, then the medications were checked and transferred to a patient specific bag by a pharmacist, and the bags were delivered to the patient-specific bins on the nurses' WOW by pharmacy technicians. The third method did not involve use of the delivery cart; individual bags were used as patient specific medications were filled, which were checked and delivered to the patient-specific bins on the nurses' WOW. Each process was completed and documented over a two-week period. At the end of the six-week period, pharmacy and nursing staff completed satisfaction surveys.

Results: Of the three methods performed, the data showed that the completely cartless method decreased delivery time by 20% and filling time by 17%. Since implementing the cartless model, HCAHPS scores related to the quietness of hospital environment have increased by 16%. Thirty-five nurses completed the nursing satisfaction survey as well, over half of which work during cart delivery hours (51%, n=18). Of those who completed the survey, 88% (n=31) stated that overall, they are satisfied with pharmacy services. Eighty-three percent (n=10) of nurses who noticed a difference in cart exchange stated that they preferred technicians delivering medications to their WOW instead of nursing moving their WOW to a designated area. Eight pharmacy staff completed the pharmacy satisfaction survey and 63% (n=5) preferred the completely cartless method.

Conclusion: Hospitals must innovate and continue to improve workflow in an effort to decrease waste and reallocate resources. Experimenting with new processes for performing the cart fill task led to increased pharmacy staff efficiency and nurse satisfaction.

Category: Leadership

Title: Development of a pre-survey action plan for an ASHP PGY1 pharmacy residency program accreditation visit at VA Central Iowa Health Care System

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Purpose: In the process of completing pre-survey materials for our PGY1 ASHP residency accreditation survey, several opportunities for improvement were identified. In order to address these opportunities, a proactive pre-survey action plan was developed prior to the accreditation visit to improve and enhance the residency program and the pharmacy department.

Methods: Pre-survey residency accreditation materials were completed by a team including the residency program director, residents, preceptors and pharmacy leadership. An open and honest assessment was completed with several areas being marked as partial compliance rather than full compliance. As full compliance was not achieved in certain areas, opportunities for improvement were easily identified. To allow more time for process improvement, a pre-survey action plan was developed by the residency program director (immediate past and interim) in consultation with pharmacy leadership. Specific tasks, deadlines and responsible individuals were identified in the pre-survey action plan to encourage development of non-compliant or partially compliant areas prior to the site visit by ASHP. Individuals responsible for items on the pre-survey action plan were informed of their assigned tasks and deadlines. Items identified in the pre-survey action plan were reported at Residency Advisory Council to monitor progress of the pre-survey action plan.

Results: The pre-survey action plan was completed prior to the ASHP on-site survey visit. During the opening session with the survey team, the pre-survey action plan was provided to the surveyors for their review. Although not all areas were fully compliant at the time of the survey visit, a detailed action plan with tasks, deadlines and responsible parties allowed the pharmacy residency team to articulate future plans and begin necessary process improvements prior to the visit. The pre-survey action plan encouraged our pharmacy residency team to be proactive in meeting ASHP standards. It provided the team additional time to work on areas which were identified by the survey team as areas for improvement such as providing constructive feedback and improving our preceptor development plan. In addition, some areas marked as partial compliance on the pre-survey materials (such as development of a residency certificate) had improved to full compliance by the time of the visit. This allowed the team to focus on other areas upon receipt of survey report. Completion of a pre-survey action plan promoted awareness within the pharmacy residency team of areas which may be identified during the ASHP on-site accreditation visit.

Conclusion: Development of a pre-survey action plan allowed our pharmacy residency team more time to begin necessary process improvements to meet ASHP residency standards. As the time between receipt of the survey report and response to the survey report is limited, development of a pre-survey action plan allowed the pharmacy residency team additional time to work on needed improvements. The pre-survey action plan promoted staff awareness of the standards and our local opportunities for improvement.

Category: Leadership

Title: Impact of an elective medical writing course on academic performance

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Purpose: Fostering effective communication skills is an essential component of a professional education, and as seen in other studies, it may also impact academic performance. The objective of this study is to characterize the relationship between enrollment in a medical writing elective and academic performance based on grade point average (GPA) and class rank.

Methods: The institutional review board approved this retrospective, observational cohort study, which examined the Spring 2011 and Spring 2012 academic performance of pharmacy students in their second professional year (P2) enrolled in the Medical Writing elective versus their peers. The primary outcome was the mean change from baseline GPA following the study semester. The secondary outcomes were progression to the next academic year, change in the percentage of students in the top 20 percent and top 50 percent, and change in the percentage of students with a cumulative GPA greater than 3.5 and 3.0.

Results: In Spring 2011, 208 students were enrolled in the P2 class at the School of Pharmacy, with 28 in the Medical Writing elective. In Spring 2012, 225 students were enrolled in the P2 class, with 16 in the Medical Writing elective. The difference in the mean change from baseline during the Spring 2011 and Spring 2012 semesters was consistently in favor of enrollment in the Medical Writing elective, but this difference was not statistically significant (difference equals 0.01 and 0.02 respectively, p greater than 0.05). More students in the Medical Writing cohort progressed to the P3 academic year in both classes, but this difference was not significant. The changes in top 20 percent and top 50 percent, as well as GPA over 3.5 and over 3.0, were inconsistent and not significant between groups.

Conclusion: Enrollment in the Medical Writing elective had a small, positive effect on GPA; similarly, academic progression to the next professional year was also higher. The relationship between enrollment in the Medical Writing elective and academic performance based on class rank classification and GPA classification was inconsistent. The study was not powered to detect a difference. Further research is warranted to determine the long term effects of a medical writing elective on future performance in didactic or experiential courses.

Category: Leadership

Title: Employee perceptions of safety culture in the cancer and heart centers in Qatar

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Purpose: This study examines staff perceptions of organizational culture of safety in two government, specialty and referral hospitals.

Methods: This is a descriptive cross sectional study. An online survey instrument was used to gather data for this study. It is adapted from an instrument developed in 2004 by the Agency for Healthcare Research and Quality (AHRQ). It assesses hospital's culture of safety by inquiring into the individual/group values, attitudes, perceptions, and patterns of behavior of the staff about patient safety issues, medical errors, and event reporting, in 12 key dimensions of safety culture. Respondents make their ratings on a 5-point Likert scale i.e. Strongly Agree, Agree, Neither, Disagree, or Strongly Disagree. The survey was conducted over six weeks from 8 July till 23 August, 2012 targeting all heart and cancer centers health care providers and clinical administrators. Data was exported as SPSS file directly from the online survey and was analyzed by SPSS version 20 using descriptive statistics.

Results: A total of 511 staff members participated in the survey; 64% (n=327) from the heart center, and 36% (n=184) from the cancer center. The majority of participants were nurses 66.3%, followed by pharmacists 9.4%, administrative staff 4.5%, technicians 3.5% and physicians 2.9%. The respondents rated highest for the dimension organizational learning-continuous improvement (87.7%), followed by teamwork within units(86.3%), management support for patient safety (83.4%), feedback and communication about error (78.8%), teamwork across units (76.1%), frequency of events reported (68.9%), overall perceptions of patient safety (62.1%), supervisor/manager expectations and actions promoting safety (61.1%), handoffs and transitions (60.5%), communication openness (53.3%), staffing (38.1%), and the lowest score was on non-punitive response to error (33.3%).

Conclusion: This study has designed to help hospitals assess the culture of safety in their institutions. The data indicate that the following top three composites had high average percent positive response i.e. organizational learning and quality improvement dimension, team work and managements commitment to patient safety, indicating it is a strength for these hospitals. The non-punitive response to error composite had the lowest average percent positive response, indicating it is an area with potential for improvement for hospitals.

Category: Leadership

Title: Impact of pharmacy elective courses designed to promote student leadership, collaborative teamwork, and professional poster skills prior to advanced pharmacy practice experience rotations

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Purpose: As healthcare has become increasingly team-oriented, it is important for pharmacy students to develop leadership skills and to collaborate in teams prior to beginning advanced pharmacy practice experience (APPE) rotations. Pharmacy elective courses provide a unique opportunity for collaborative learning and student professional development including leadership skills in small group settings. This project will determine the impact of incorporating student group projects that foster leadership opportunities, teamwork, and professional poster skills within pharmacy elective courses prior to APPE rotations.

Methods: Five pharmacy elective courses offered during Professional Year 3 of the PharmD Program at a health care university that enrolled 116 students participated in this study. While each elective course had a different specialty focus, all five courses had the same requirements for student group projects. All classes received faculty instruction regarding the group projects, and a workshop focused on poster design and presentation skills was given by a media production specialist. Students were divided into teams for group projects and functioned as teams throughout the semester to develop project concepts, determine each team members role and contribute to group projects that resulted in a poster presentation at the university. Pre- and post-test surveys were designed by faculty to assess the impact of student group project experiences. Students were invited to complete the pre-test survey at the start of the semester and the post-test survey at the end of the semester after presenting their group projects. In addition to demographic data, students were surveyed regarding their level of preparedness to contribute as a team member on group projects, and their perceived benefits of these types of experiences. The survey was approved by the university Institutional Review Board. McNemars test was used for statistical analysis of the data.

Results: A total of 28 student groups from the five elective courses designed, developed, and presented the group projects. Student group posters were reviewed and critiqued by faculty coordinators for content and by a media production specialist for poster design. A poster presentation event was hosted at the university and student groups led the discussions and answered questions from faculty and students regarding their projects. A total of 105 students

(90%) completed the pre- and post-test surveys regarding their group project experiences. Seventy percent of students were female and 30% were male and 92% of students were between the ages of 22 to 25. Prior to taking their pharmacy elective course, only 20% of students had previously prepared a poster at the university and only 12% had presented a poster at a professional meeting. Most students surveyed believed that the opportunity to collaborate as a team member on their group project would be beneficial (90% pre-test vs. 94% post-test; no significant change). However, when asked regarding their level of preparedness to contribute effectively as a team member on group projects, 86% vs. 95% of students felt prepared (pre-and post-test surveys, respectively; statistically significant, $p=0.025$).

Conclusion: The five elective courses were effective in designing educational opportunities that fostered student leadership, promoted collaborative team-work, and professional poster skills. The pre- and post-test findings indicated that students felt more prepared to work effectively as a team member on group projects at the end of the semester. Student feedback was highly positive and indicated that they gained confidence in their presentation skills and their ability to work in teams. Our findings support benefits for collaborative team-work and professional presentation development prior to APPE rotations. Students have been encouraged to present their group project work at the ASHP midyear clinical meeting.

Category: Operating Room Pharmacy

Title: Evaluation of the continuation of beta-blockers perioperatively in non-cardiac surgery patients

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Purpose: Non-cardiac surgeries have been associated with post-operative cardiac complications. Research has shown that the use of beta-blockers during the perioperative period may decrease the complications, but adverse effects, such as hypotension and bradycardia, make their use controversial. This study evaluated the post-operative cardiac outcomes of continuing beta-blockers during the perioperative period in non-cardiac surgery patients.

Methods: This study was a single-center, IRB approved retrospective chart review of patients on a beta-blocker prior to admission who underwent a non-cardiac surgery. Patients in the beta-blocker group received a beta-blocker on the day of surgery, post-operative day 1, and post-operative day 2. The incomplete beta-blocker group included patients who did not receive a beta-blocker on all three days. The primary objective was to evaluate if the continuation of beta-blockers during the perioperative period had an effect on a composite endpoint of post-operative cardiac complications (i.e., death, ischemia, MI, or arrhythmias) during index hospitalization. Secondary endpoints included post-operative MI, post-operative ischemia, post-operative cardiac arrhythmias, post-operative cardiac death, post-operative stroke, hypotension, bradycardia, length of stay (LOS), intensive care unit (ICU) LOS, and 30-day readmissions due to cardiac complications.

Results: A total of 384 patients were screened and 203 patients were enrolled in the study. The beta-blocker group included 103 patients, while the incomplete beta-blocker group included 100 patients. Differences in baseline characteristics between the two groups, included a higher percentage of males (55.3% vs. 39.0%; $p=0.0197$) and less high-risk surgeries (7.8% vs. 22.0%; $p=0.0043$) in the beta-blocker group compared to the incomplete beta-blocker group. The study found that the continuation of beta-blockers during the perioperative period did not significantly affect the incidence of the composite endpoint of post-operative cardiac complications (beta-blocker: 7.8% vs. incomplete beta-blocker: 8.0%; $p=0.7432$). LOS and ICU LOS were shorter in the beta-blocker group (4.88 vs. 6.83 days, $p=0.0144$; 3.22 vs. 6.40 days, $p=0.0296$ respectively).

Conclusion: The continuation of beta-blockers perioperatively was not associated with a statistically significant difference in post-operative cardiac complications during index hospitalization among non-cardiac surgery patients. LOS and ICU LOS may be reduced by the

continuation of beta-blockers perioperatively, but differences in the surgery populations may have contributed to these findings. Larger, multi-centered studies focusing on patients with a history of multiple comorbidities and undergoing high-risk non-cardiac surgeries are needed to determine the most appropriate use of beta-blockers perioperatively.

Category: Pain Management

Title: Reduction of high-dose opioid use for chronic non-cancer pain through implementation of an opioid surveillance program.

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Purpose: Current evidence suggests that high-dose opioid use significantly decreases patient safety while providing minimal additional benefit in the treatment of CNCP. The purpose of this project is to implement an opioid surveillance program targeted at identifying Veterans currently receiving high-dose opioids (defined as greater than or equal to 200 mg morphine equivalents (ME) daily) and recommending a dose decrease to the provider to less than or equal to 200 mg ME daily for the treatment of CNCP. The secondary purpose of this project is to provide education and tools for the documentation, assessment, management, and treatment of CNCP.

Methods: All patients who received at least 200 mg ME daily for the treatment of CNCP were assessed for meeting data collection criteria. Patients were not included if they had active cancer or were receiving hospice/palliative care. For patients meeting project criteria, an attempt to identify the type of pain at diagnosis, pain indication, treatment goal, and pain scale at initiation of therapy was completed. Additionally, an attempt to identify treatment goals at follow-up visits, medications for the treatment of CNCP, pain scores at each visit, provider assessment of pain, random drug screens, pain contract/agreements, substance abuse admissions/treatments, and adverse outcomes from substance abuse within the past year was completed. Clinical Pharmacy Specialists (CPS) made recommendations for tapering of high dose opioids down to a maximum of 200 mg ME daily. CPS also recommended adjunct therapy for treatment of CNCP as appropriate. Follow-up searches to identify new patients receiving more than 200 mg ME daily, patients who reached the less than or equal to 200 mg ME daily goal, and a secondary assessment of the same criteria mentioned previously were completed. Follow-up assessment of the educational component is based on changes in documentation procedures for CNCP.

Results: Fifty-six patients met pre-specified project criteria. At the follow-up chart review in April 2013, 28 patients had started the tapering process. Of these 28 patients, 7 patients had tapered to the goal of less than 200 mg ME daily. For the 21 patients currently undergoing the tapering process, 71 percent report that their pain remains adequately controlled while the remaining patients had inadequate pain control prior to the tapering process. For the 7 patients at goal, 71 percent report adequate pain control with doses less than 200 mg ME daily and the remaining patients did not have adequate pain control prior to the tapering process. Fifty percent

of patients had pain scores documented, 55 percent of patients had functional assessments documented, and 18 percent of patients had pain goals documented at the initial chart review. One hundred percent of patients had pain scores documented, 82 percent of patients had functional assessments documented, and 32 percent of patients had pain goals documented at the follow-up chart review. Forty-six percent of patients undergoing the tapering process had chart documentation using the opioid safety initiative templates.

Conclusion: The utilization of high-dose opioid analgesics represents significant safety risks while offering little known benefit in the treatment of CNCP. The opioid surveillance program was created to increase patient safety by limiting the total number of ME to 200 mg daily. Implementation of the opioid surveillance program has been well received by the healthcare staff. Documentation of the assessment, management and treatment of CNCP has improved considerably since initiation of this program. Based on the results of this project, quarterly updates will be provided to health care professionals to ensure continued success of the opioid safety initiative.

Category: Pain Management

Title: Medication use evaluation of oxycodone sustained-action (SA) within a rural VA health care system.

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Purpose: Oxycodone sustained-action (SA) is one of the most heavily abused prescription medications in the United States and it has become the primary opioid of abuse. In terms of efficacy, oxycodone SA offers no additional benefit in the treatment of chronic pain as compared to other medications in the same class. Oxycodone SA is a non-formulary agent within the VA Healthcare system and this facility is the highest utilizer of oxycodone SA within its service network. The purpose of this medication use evaluation was to ensure the safe and appropriate utilization of oxycodone SA within our healthcare system.

Methods: A FileMan report was used to identify all patients receiving oxycodone SA over a 90 day time period within our healthcare system. All patients who received oxycodone SA, excluding those with active cancer or receiving hospice/palliative care, were included in the chart review. The VA uses a formulary system and the use of oxycodone SA is restricted to specific criteria. This criteria was utilized in the chart review and includes: moderate to severe chronic pain, requirement for around the clock analgesia, ability to take oral medications, history of intolerability to morphine or methadone despite aggressive adjunctive therapy for treatment of side effects, or history of intolerability to morphine and a provider trained in the use of methadone was not available at the time of the oxycodone SA request. Additional criteria assessed in the chart review included: starting and current oxycodone SA dose, previous use of morphine SA, methadone, or fentanyl patch, use of adjunctive therapy for treatment of opioid related side effects prior to switching to oxycodone SA, documented reason for change to oxycodone SA, functional assessments, pain goals, pain scores, and opioid safety agreements.

Results: Fifty-eight patients met pre-specified chart review criteria. Ninety percent of all patients met the first three criteria for use recommendations which included moderate to severe chronic pain, the need for around the clock analgesia, and the ability to take oral medications. Ninety-one percent of patients had tried morphine or methadone prior to initiation of oxycodone SA. Twenty-one percent of patients had tried aggressive adjunctive therapy prior to initiation of oxycodone SA. Most commonly reported adverse effects from morphine or methadone included GI upset/distress, itching, and central nervous system depression. Side effects were typically reported as mild and were rarely documented as a reason for discontinuation in therapy. One-

third of all patients had a documented intolerability to the previously listed agents. Eighty-one percent of patients had functional assessments documented and ninety percent of patients had pain scores documented. Seven percent of patients had pain goals documented and thirty-three percent of patients had an opioid safety agreement in place.

Conclusion: There are significant risks associated with the use of oxycodone SA while there is minimal benefit in comparison to other long-acting agents. Based on the results of this project, oxycodone SA was not meeting prespecified national criteria for use recommendations. Patients will be converted to alternative long-acting agents with follow-up assessment focused on pain control, pain scores, functional assessments, and pain goals. Continual updates will be provided to healthcare professionals to ensure follow-up and success of the opioid surveillance program.

Category: Pain Management

Title: Physical and chemical compatibility of IV acetaminophen with common IV medications

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Purpose: IV acetaminophen received FDA approval for the management of mild to moderate pain, the management of moderate to severe pain with adjunctive opioid analgesics, and reduction of fever in the U.S. in November 2010. Prior studies have demonstrated the physical and chemical compatibility of IV acetaminophen with various intravenous medications and bulk fluids. The purpose of this study was to determine the physical and chemical stability of OFIRMEV (acetaminophen) injection co-infused with seven additional medications commonly given perioperatively to surgical patients.

Methods: IV acetaminophen (10 mg/mL) was tested for physical and chemical one-way stability with cefazolin, dexmedetomidine, gentamicin, magnesium sulfate, metronidazole, oxytocin and protamine sulfate over 1 hour at room temperature via simulated Y-site administration. Each combination was prepared in duplicate, reversing the order of drug addition between the two agents. Physical compatibility was assessed at baseline and at 1 hour via visual inspection under normal laboratory lighting and a Tyndall high-intensity directional lighting beam. The samples were further assessed post-preparation using a turbidimeter which permits quantification of any haze and assessment of any changes, regardless of whether haze is visually apparent. Additionally, the particle content of the samples was quantified using a light obscuration particle counter to determine particle content in the size range of 2 to 112 m. Chemical compatibility was assessed by measurement of acetaminophen concentrations with the same set of drug solutions via a validated HPLC method.

Results: Cefazolin, dexmedetomidine, gentamicin, magnesium sulfate, oxytocin and protamine sulfate all exhibited physical compatibility with IV acetaminophen. Metronidazole was noted to have a yellow tint prior to mixing with IV acetaminophen. Additionally, at 1 hour, there was an increase in turbidity measurement for the metronidazole/acetaminophen sample when compared to baseline. Particle count analysis did not reveal any deviations from USP standards for any solutions. Chemical compatibility analysis with HPLC revealed no significant change in acetaminophen concentrations which was recovered in the cefazolin, dexmedetomidine, gentamicin, magnesium sulfate, oxytocin, and protamine solutions at baseline and at 1 hour. Chemical compatibility of IV acetaminophen with metronidazole could not be assessed via the HPLC test method employed due to the overlapping and concurrent peaks noted with each agent individually.

Conclusion: IV acetaminophen exhibited physical and chemical compatibility with cefazolin, dexmedetomidine, gentamicin, magnesium sulfate, oxytocin and protamine via simulated Y-site analysis. Physical and chemical compatibility of IV acetaminophen with metronidazole could not be assessed due to the increase in turbidity of the solution at 1 hour along with the inability to quantify acetaminophen recovery via HPLC due to the co-eluting and overlapping peak profile for these two agents.

Category: Pain Management

Title: Risk factors associated with naloxone use in an adult inpatient population

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Purpose: The Joint Commission sentinel event alert released in August of 2012 highlighted the problem of opioid related over sedation among inpatient populations. In this alert, the Joint Commission presented risk factors that may be related to this issue. The objective of this study was to determine the influence of these various risk factors in patients who are on opioid medications.

Methods: A retrospective chart review was conducted at a 350 bed acute care community hospital in order to determine risk factors in patients who experienced opioid related over sedation during fiscal year 2012. Data was gathered using naloxone administration as reported by the hospitals electronic dispensing records from October 1, 2011 to September 30, 2012. A total of 169 naloxone patient profiles were reviewed. Patients were excluded if naloxone was used within 24 hours of being admitted, no opioid was used within the 24 hours previous to naloxone administration, or naloxone was used in either the operative room or post anesthesia care unit. The 65 patients that remained were reviewed to identify the presence and type of risk factors for opioid-induced respiratory depression: age, body mass index, smoking history, presence of cardiac/respiratory/hepatic/renal disease, or the use of any central nervous system (CNS)-sedating medication. Each patient case was matched with a control patient who did not receive naloxone, according to daily opioid equivalents used.

Results: Patients who received naloxone had a high prevalence of concomitant CNS-sedating medication use (87.69%), smoking history (64.61%), renal disease (49.23%), cardiac disease (61.54%), and respiratory disease (61.54%). Patients in the naloxone group demonstrated an average of 5 risk factors for opioid-induced respiratory depression, compared with an average of 3.3 in the control group ($p < 0.001$). Analysis of the risk factors identified five with statistically significant associations. The presence of renal disease had an odds ratio (OR) of 6.034 (95%CI 2.565-14.195), cardiac disease had an OR of 5.829 (95%CI 2.687-12.642), the use of a CNS-sedating medication had an OR of 4.750 (95%CI 1.949-11.578), a positive smoking history had an OR of 4.7421 (95%CI 2.114-9.256), and respiratory disease had an OR of 3.600 (95%CI 1.742-7.441). The remaining risk factors had no significant odds ratio. Analysis of the groupings of risk factors was unable to identify any common clustering of risk factors that were more likely to be associated with naloxone utilization. In this analysis, it would appear that the total number

of risk factors was a stronger predictor of naloxone utilization rather than the type of risk factor combination.

Conclusion: The risk factors that have shown to increase a patients risk of opioid related over sedation include renal disease, cardiac disease, respiratory disease, smoking history, and the use of non-opioid CNS depressants. These five risk factors can be used to identify patients at risk for opioid related over sedation. Once at-risk patients are identified, hospital staff can closely monitor patient sedation and more carefully prescribe medications in order to reduce the instance of opioid related over sedation.

Category: Pain Management

Title: Implementation of naloxone trigger tool guided opioid practice changes at a community teaching hospital

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Purpose: In August 2012, the Joint Commission issued a sentinel event alert addressing safe inpatient opioid practices. This alert suggested multiple actions to be taken by hospitals. A previous project phase performed at Munson Medical Center found that naloxone triggers are an effective tool for identifying problems with opioid-related respiratory depression. The objective of this subsequent project phase is to utilize opioid focus areas identified by the naloxone trigger tool to improve associated processes and practices for hospitalized patients at risk for opioid-related adverse drug events (ORADEs).

Methods: An examination of the hospitals inpatient chronic pain population was undertaken because of the results of the naloxone trigger tool project phase. Chronic pain patients were identified based on patient response during initial nursing assessment. For all patients who stated they suffer from chronic pain, the total number of opioids, the number of short-acting opioids, and the number of long-acting opioids were measured. This measurement occurred over a two week period. A unit-specific analysis of chronic pain patients would then be performed to examine pharmacist interventions on the containment of opioid orders. Naloxone trigger tool project leaders also reviewed the first phase project results with providers from multiple health care disciplines and hospital committees in order to develop action plans for pain management and monitoring process changes. These groups included the pharmacy and therapeutics committee, pain management committee, and medication occurrence review committee.

Results: From 778 patient admissions to Munson Medical Center over a two week time span, 260 patients (33.4%) stated that they suffer from chronic pain and were ordered opioids upon hospitalization. Post-surgical unit admissions included 55 of these patients (21.2%). Implementation of specific pharmacist interventions was directed based on electronic communication and verbal instruction. These interventions included limiting use of duplicate oral short-acting opioids, limiting use of oral short-acting opioids when patients are also treated with patient-controlled analgesia, suspension of oral opioids while patients are on epidural/intrathecal infusion, and use of fentanyl patches only in opioid tolerant patients. Pain management order set modifications were performed to reduce the potential for duplicate opioid therapies. Additionally, presentation of first project phase results facilitated the development of several process improvement teams. An interdisciplinary group of nurses, pharmacists, and respiratory therapists was formed to delineate the use of respiratory monitoring parameters in the

chronic pain population. A business plan to develop a pain management resource team to facilitate the care of complex cases has been initiated. Finally, a gap analysis of suggested actions from the Sentinel Event Alert has commenced to ensure compliance with Joint Commission recommendations.

Conclusion: The patient population sampled within the two week time span indicates that many patients admitted to Munson Medical Center suffer from chronic pain and are managed with three or more opioids. Order set modification and tracking of pharmacist interventions are two processes which will be implemented and evaluated in order to preclude ORADEs. Further interdisciplinary work will include the examination of chronic pain patients through risk stratification, development of protocolized end-tidal CO₂ and pulse oximetry monitoring for at-risk patients, and examination of post-operative use of opioids.

Category: Pharmacokinetics

Title: Factors influencing cyclosporine pharmacokinetics in pediatric allogeneic hematopoietic stem cell transplantation

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Purpose: Cyclosporine (CsA) is used as an immunosuppressant for the prevention of rejection and graft-versus-host disease in allogeneic hematopoietic stem cell transplantation (aHSCT). In contrast, high levels of CsA may cause adverse effects including nephrotoxicity, hepatotoxicity, neurotoxicity, and infections. However, plasma concentrations of CsA are variable among patients or even within the same patient. So, careful monitoring of blood levels is required for CsA therapy. In view of the lack of an understanding on CsA pharmacokinetics in children, this study investigated the factors that influence the parameters of CsA pharmacokinetics in the patients underwent with aHSCT retrospective analysis of EMR.

Methods: One hundred twenty four allo-HSCT patients admitted to Seoul National University Childrens Hospital from October 15 2004 to December 31 2011 were grouped into three depending on age: pre-school, school, and adolescent. Factors related with patient characteristics, transplantation type, CsA, coadministered drugs, laboratory data, and side effects were examined as the factors that potentially influence its pharmacokinetics using NONMEM®(version 7.2.0) program, whereas those on CsA blood levels were analyzed using generalized estimating equations (GEE).

Results: CsA clearance depended on age group, body weight, and body surface area. The factors that affected CsA plasma concentrations included age, administration route, hematocrit levels (HCT), serum creatinine (Scr) levels, CsA dose per weight, and concomitantly administered drugs. In particular, CsA levels in those of school age and adolescent were 1.14- and 1.37- times greater, respectively, than pre-school age, raising the possibility that CsA dose needs to be reduced by 12.28% and 27.01% in the groups. CsA levels were also increased by 24% when HCT was 36% or by 1.76% per unit of Scr increase. In addition, CsA levels in plasma were decreased by 56.87% and 28.41% when rifampicin and phenytoin were concomitantly used. Prednisolone also increased CsA concentrations by 30.42%. The risk of nephrotoxicity in school age and adolescent were 6.08% and 30.85% higher, respectively, than that of pre-school age. The concentration of CsA was 25.11% reduced by amphotericin B administration, which may have resulted from prior adjustment of CsA dose in combination with the nephrotoxic drug.

Conclusion: Our results showed that CsA blood levels may be affected by the factors of age group in children, level of HCT, serum Scr, concomitant medications, suggesting that suitable dose adjustment and careful observation may be necessary for CsA therapy in children depending on the identified factors.

Category: Pharmacokinetics

Title: Evaluation of cyclosporine protocol for new liquid chromatography tandem mass spectrometric assay in hematopoietic stem cell transplantation recipients

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Purpose: Cyclosporine (CsA) is used to prevent Graft-versus-host disease (GvHD) following hematopoietic stem cell transplantation. Because CsA has narrow therapeutic ranges, and larger intraindividual variability of pharmacokinetic process, monitoring of blood concentration and dose adjustment of CsA is critical to maintain therapeutic range and prevent adverse effect. To achieve more precise and accurate analytical results, the CsA concentration assay method was changed from Affinity column mediated immunoassay (ACMIA) to Liquid chromatography-tandem mass spectrometry (LC-MS/MS), which has no cross-reactivity with CsA metabolites. This study was conducted to determine whether current CsA protocol change would be needed due to new LC-MS/MS method application.

Methods: Acute Myelogenous Leukemia (AML) and Acute Lymphocytic Leukemia (ALL) patients administrated CsA via intravenous route after hematopoietic stem cell transplantation, before and after 6 months of new CsA assay method application (from August 2011 to August 2012), were screened. These patients were divided into 2 groups according to CsA assay method; ACMIA group and LC-MS/MS group. The percentage of CsA target concentration achievement, CsA blood concentration (ng/ml) and CsA dose (mg/kg) in the therapeutic drug monitoring (TDM) reports and the medical record of each group were retrospectively analyzed.

Results: Of total 225 CsA blood concentration assay results, 59.1% (133/225) were measured by new LC-MS/MS method. For CsA target concentration achievement, two methods showed similar achievement rate; ACMIA group 42.4% (39/92 cases) vs LC-MS/MS group 42.9% (57/133 cases) (target therapeutic range; 200-300ng/ml, $p>0.05$). The mean blood concentration of CsA (ng/ml) per dose (mg/kg) was lower in LC-MS/MS group (2.170.64) than ACMIA group (2.61 0.92) ($p<0.001$), and the mean dose of CsA per body weight (mg/kg) was higher in LC-MS/MS group (2.37 0.69) in ACMIA group (1.99 0.66) ($p<0.001$). There was significant difference in the mean dose of CsA per body weight (mg/kg) of CsA target concentration achievement cases (total 96 cases, 39 of ACMIA and 57 of LC-MS/MS) between two groups; 1.78 0.52 in ACMIA group vs 2.17 0.57 in LC-MS/MS group ($p=0.0008$).

Conclusion: In conclusion, though target concentration achievement was not significantly different, the blood concentration of CsA (ng/ml) per dose (mg/kg) and CsA dose per body weight (mg/kg) showed significant difference(reduced about 16.9% and increased about 21.9%, respectively) after new LC-MS/MS method application. According to the results, it is recommended to modify current CsA protocol based on new LC-MS/MS method.

Category: Pharmacy Law / Regulatory / Accreditation

Title: Unprofessional online behavior of licensees: a survey of boards of pharmacy

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Purpose: To determine how often boards of pharmacy (BOPs) receive complaints related to licensees online behavior, and what types of online behaviors may prompt an investigation of a licensee.

Methods: A survey (consisting of questions related to BOPs management of complaints against licensees online behavior and 10 case vignettes) was adapted from a previous survey of United States medical boards. Vignettes encompassed themes such as patient confidentiality, derogatory language, alcohol use, false or misleading product claims, and others. Following institutional review board approval, survey materials were distributed via email to by the National Association of Boards of Pharmacy to 63 United States and international boards of pharmacy. Completed surveys were analyzed using descriptive statistics. The proportion of respondents who indicated that the vignette would very likely or likely result in an investigation was used to determine consensus. Proportions of >75%, 50%-75% and <50% were classified as high, moderate and low consensus, respectively.

Results: Fourteen completed surveys (22.2%) were received. Sixty percent of respondents stated that the board has been involved in managing a complaint regarding the online behavior of a licensee, and that disciplinary actions including revocation or suspension of license, letter of reprimand, and monetary fines have been enacted. While 79% of BOPs have a policy regarding Internet usage, 36% are unsure whether the policies are sufficient to cover online professionalism. One vignette, where a pharmacist made misleading claims regarding a compounded product, achieved high consensus for likelihood to prompt an investigation. Moderate consensus was achieved for a breach of patient confidentiality, inappropriate alcohol use, and misrepresentation of professional credentials.

Conclusion: Boards of pharmacy are widely varied in what types of online behaviors may prompt an investigation. Additional dialogue is needed among pharmacy leaders to determine best practices.

Category: Pharmacy Law / Regulatory / Accreditation

Title: Implementing USP 795 standards: establishing quality in processes

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Purpose: Chapter 795 of U.S. Pharmacopeia (USP 795) governs rules and regulations for non-sterile drug compounding. Following the update and republication of the chapter in 2011, the Pharmacy Department began assessing current compliance with the chapter and determining future actions to address potential compliance issues.

Methods: An ad hoc Pharmacy Department Committee was instituted to direct the department on changes needed to achieve compliance with non-sterile compounding guidelines. The Committee included pharmacy representatives from two inpatient practice areas, three outpatient practice areas, pharmacy management, and a coordinator. The Committee developed a gap analysis which outlined each USP 795 requirement in detail. To meet the intent of each standard, the following items were documented: compliance with the requirement, department action plan to achieve compliance and completion dates. Facility and equipment requirements, as well as training procedures, were addressed. Each drug formulation was reviewed in detail for items such as availability of a reliable reference, appropriate beyond use dating, and labeling requirements.

Results: For each drug preparation, Master Formulation Records and Compounding Records were developed for use in all pharmacy areas. These records were housed in a newly created section of the Pharmacy Department intranet for easy accessibility by all staff. For high volume drug formulations where an extended beyond-use-date was desired, the compound was submitted for independent laboratory analysis. Non-sterile compounding policies and competency validations were created. Pharmacy staff was educated at special CPE presentations and through training and competency validations.

Conclusion: Through focused Pharmacy Department efforts, non-sterile compounding practices have been reviewed and improved. The department is better suited to provide patients with the highest quality non-sterile products.

Category: Pharmacy Law / Regulatory / Accreditation

Title: Development of a Comprehensive Corrective Action Plan for Compounding in Massachusetts: The 2013 Massachusetts Special Commission on Compounding Report

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Purpose: The fungal meningitis outbreak of 2012 and subsequent patient deaths has placed the spotlight on the pharmacy compounding industry. As of June 14th, 2013, there have been 58 deaths and 745 infections across 20 states. In response to the poor conditions at the New England Compounding Center in Framingham, MA and lack of regulatory oversight of the industry, Massachusetts Governor Deval Patrick convened a Special Commission to investigate the compounding industry and make recommendations for improvement. The Commission undertook an intensive and focused study of compounding practices in Massachusetts, relying on perspectives from pharmacists, regulators, physicians, epidemiologists, health law practitioners and legislators to protect the public and to minimize the risk of drug shortages.

Methods: The Special Commission was comprised of four pharmacists, five legislators (senate and house), one public member, and one Massachusetts Department of Public Health representative. The Special Commission approached its charge with the following three principles in mind: (1) safety and quality is the foundation for all compounding activities; (2) compounding is a necessary service to meet the needs of patient care; and (3) oversight of pharmacy practice must be just, transparent, and comprehensive. In five meetings held between November and December 2012, the Special Commission achieved consensus on several statutory, regulatory, and operational recommendations.

Results: The Special Commission Report detailed 25 recommendations focusing on (1) Board of Pharmacy composition and advisory groups; (2) Board of Pharmacy staff training; (3) statutory and regulatory changes; (4) Board of Pharmacy operational policies; (5) regulatory and USP standards; and (6) other recommendations for the compounding industry. Within the 25 recommendations, the Special Commission provided 32 specific improvement plans to enhance the compounding industry and oversight. The report was submitted to the Massachusetts Governors office for consideration and legislation.

Conclusion: The pharmacy industry, especially as it pertains to compounding, continues to evolve as it adapts to a changing market. The Special Commissions recommendations represent significant steps toward improving the safety and quality of compounding practices in

Massachusetts. The recommendations represent best practices for the industry and should be evaluated in each state board of pharmacy.

Category: Pharmacy Law / Regulatory / Accreditation

Title: Time critical medications: assuring compliance with CMS guidelines

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Purpose: On November 18, 2011, CMS announced a relaxation of the long-standing 30-minute rule for medication administration. With this change, only medications deemed time-critical are required to meet the 30-minute before or after time-due standard. However, differentiating "time-critical" from "non-time critical" was a new concept for Nursing, and this required implementation of new standards. This project was undertaken to assure compliance with CMS 30 minute rule for time-critical medications in an 8 campus health-system encompassing approximately 2,000 inpatient beds.

Methods: A task force of nurses and pharmacists reviewed the CMS and ISMP definitions and identified 25 medications. The list was further edited by the Nursing-Pharmacy and Medication Safety Committees, and then sent to expert panel chairs, who obtained feedback from their department. The final list was submitted to the Pharmacy and Therapeutics (P&T) Committee, and was ultimately approved by the Medical Executive Committee. The final list included: tacrolimus, epoprostenol, treprostinil, dofetilide, cyclosporine, and pyridostigmine immediate-release. Because time-critical medications was a new concept, communication was vital. Communication began in late November, 2011 and included: emails, posters, energizers, team huddles, staff meetings, new nurse orientation, pharmacist education, and an electronic notice on the sign-in screen for the electronic health record. Electronic forcing functions included a review of the standard dosing times assigned to each of the 6 medications in the computerized provider order entry (CPOE) and in the pharmacy order entry system. An order comment, viewable to the nurse, was added to the eMAR. To further increase compliance, the words "time critical medication" were added to the name of the medication. A Time-critical medication report is sent daily to each Chief Nursing Officer. Non-compliance is reviewed by safety and quality specialists.

Results: From June 26, 2012 to March 31, 2013, a total of 19,493 time-critical medication doses were administered. The medication with the most early/late doses was tacrolimus, followed by pyridostigmine immediate-release, cyclosporine, dofetilide, and treprostinil. There were no instances of early/late administration of epoprostenol. Compliance has improved steadily, from 86% in June to 95% in March, 2013. Of the doses administered outside of the 30 minute window, 24% were given too early, and 76% were given too late. Daily monitoring continues.

Conclusion: This project supports timely med administration, and helps Pharmacy keep the commitment to have medications available for on-time administration. It also allowed us to leverage electronic solutions as we continue to move towards a paper-free patient care environment. Each new medication added to the formulary will be evaluated for time-critical status, and the list will be revised as needed. The input from our physician expert panels was invaluable, as was the support from P&T and Medical Executive Committee. This project allowed us the opportunity to work collaboratively with our nursing and physician partners to improve patient safety with medications.

Category: Pharmacy Law / Regulatory / Accreditation

Title: Forcing functions improve physician notification for long-acting insulin omissions

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Purpose: CMS requires that hospital policies and procedures address actions to be taken when scheduled medications are not administered within their permitted time window. The policy must also address when nurses are allowed to use their own judgment regarding the rescheduling of missed or late doses, and when it is appropriate to contact the prescribing provider. Concerns were identified related to long-acting insulin. The purpose of this initiative is to provide clarity for insulin administration, and to provide an electronic forced function which alerts the provider when long-acting insulin is not administered.

Methods: Initially, policies regarding omitted medications were clarified to assist the nurse in determining when to notify the provider immediately, or when notification could wait until the next day. The delineating factor was whether there was harm or potential for harm. The policy also clarified that insulin should not be held without a specific order. Next, the reasons provided in the electronic medication administration record for not giving a medication were limited and clarified, and re-education was provided. An electronic notification linked to use of charting "not given" was developed within the electronic medical record. All doses charted as not given were viewable on the Patient Summary page. It quickly became apparent that, for some forms of insulin populating this notification screen, the nurse actually had an order, based on standing parameters. Improvements in this electronic notification were made by removing not given insulin doses associated with correctional scale, and limiting the view to the previous 96 hours. An audit of long-acting insulin doses charted as not given was performed to identify the primary reasons that this medication was not given, to determine appropriateness of nurse decision to hold, to increase appropriate administration of long-acting insulin and to monitor provider notification.

Results: Long-acting insulin doses charted as not given have been monitored since January, 2013, and are easily identifiable for the provider and clinician by viewing the patient summary tab in the electronic medical record. In our 2000 bed system, 20-40 long-acting insulin doses are designated as not given each day. Since limiting and clarifying the reason options for not given, documentation has improved. Current reason choices are limited to: charted on downtime MAR, not required per physician order, patient already took today, patient off floor for diagnostic testing, patient on intravenous insulin, patient refused, and other. A daily report of long acting

insulin doses not given, identifying patient, clinician, and reason held is sent to the chief nursing officer and a multidisciplinary team involved in glycemic management. While we have not seen a significant decrease in the overall number of long-acting insulin doses held daily, our process continues to evolve. Providers and clinicians have received glycemic management education. The nurse receives notice on the MAR and Pyxis advising that provider must be contacted if long-acting insulin is held. We have standardized our long-acting insulin administration time, because some of the not given doses were due to duplicate orders on the eMAR.

Conclusion: All scheduled medications charted as "not given" are now viewable on the patient summary tab in the electronic medical record. Through educating proper use of a limited number of reasons for holding long-acting insulin, we have addressed common misperceptions around this medication. This has improved glycemic management dialogue between nurse, dietician, pharmacist, patient and physician. This initiative identified that clinicians use multiple methods for documenting physician notification besides the new electronic notification viewed in the patient summary tab. Next steps involve limiting options for documenting physician notification in the electronic medical record when immediate notification is warranted.

Category: Pharmacy Technicians

Title: Pharmacy Technicians in the ED: Medication Histories, Error Prevention and Other Pharmacy Services

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Purpose: Eighteen percent of serious, preventable adverse drug events stem from practitioners having insufficient information about patients before prescribing, dispensing, and administering medications. Complete and accurate medication histories and detailed allergies would decrease the potential for adverse events in the hospital due to incomplete information. According to a recent review of the literature key aspects of successful interventions with hospital based medication reconciliation practices include intensive pharmacy staff involvement. Pharmacy technicians with excellent customer service skills and knowledge of common medication names, doses and frequencies can efficiently obtain accurate and complete medication histories.

Methods: In October, 2011 a strategic initiative to hire pharmacy technicians to assist in specialized roles to support clinical pharmacy services was developed. The plan was to hire Medication Intake Coordinators (MICs), pharmacy technicians with specialized training, to complete home medication and allergy histories in the Emergency Departments (ED) of two hospitals in a health system. Safety and financial data to justify the positions were gathered and presented to the executive management team. Following approval of the positions, the plan for their training and education was developed. This plan included a standardized home medication interview process and training in medication safety. MICs were hired and trained July of 2012. They are scheduled from 11:30 until 20:00 in the EDs. In the ED they prioritize patients, obtain medication histories using a standardized interview process and then document the home medication list in the electronic medical record. Documentation includes complete prescribing information, indication, last dose taken and compliance information. All clinical concerns or requests for drug information are directed to the pharmacist by the MIC. The accuracy and completeness of the medication histories obtained are monitored by the pharmacist and any issues identified are addressed using the hospital's performance improvement model.

Results: A retrospective analysis of home medication histories was conducted after the MICs completed training. In comparison to nurses, MICs were able to document an average of 7 home medications per patient while nurses were able to document an average of 4 medications per patient. Furthermore, review of the completeness of the medication histories showed more complete documentation by MICs when compared to nurses. Over 97% of the MICs medication

histories were complete and accurate whereas only 8% of the nurses medication histories contained accurate and complete information. MICs document their interventions daily. The categories of medication discrepancies that they have intervened on include incomplete medication information, omitted medication, duplicated medication, patient not on documented medication, incorrect medication/dose/dosage form/frequency/route of administration, missing last dose taken/compliance, medication history not obtained, drug allergy not documented, and incorrect allergy documentation. The most common medication discrepancies identified were omitted medication, and incorrect medications. Their medication histories have prevented Look Alike Sound Alike medication errors and their presence in the ED has prevented contraindicated medications from being administered. In addition to medication history duties, the MICs act as another member of the pharmacy staff in the ED assisting the pharmacist in all requested tasks.

Conclusion: The MIC services have been well received by both physicians and nurses. Their work is appreciated by pharmacists as well who do discharge medication reconciliation and counseling. Analysis of their work shows that they obtain complete and accurate home medication histories and prevent medication errors. By being in the ED they have been able to act as an extension of the pharmacist allowing for more opportunities for pharmacy interventions. Expansion of the MIC Program and expansion of the standardized home medication interview throughout the health care system are included in Pharmacy's 2013 strategic initiative

Category: Pharmacy Technicians

Title: Medication reconciliation technician program at The Hospital of Central Connecticut

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Purpose: In May 2012, The Hospital of Central Connecticut (THOCC) went live with implementation of CPOE and electronic health records (EHR). The hospitals previous, paper-based medication reconciliation process was a known source of numerous difficulties, including incomplete information regarding outpatient medications, unclear medication directions for discharged patients, and an unclear medication reconciliation process at transitions of care. The implementation of CPOE and EHR was an opportunity to develop an improved medication reconciliation process, beginning at the time of each patients admission with electronic documentation of home medications by pharmacy technicians.

Methods: Between the New Britain General and Bradley Memorial campuses of THOCC, there are 110,000 ED visits and 22,000 hospital admissions each year. The medication reconciliation technician (MRT) program provides 24/7 coverage in the ED at the New Britain General campus, with overlap MRT coverage during the busiest times. The hospital has 7 medication reconciliation technicians (MRTs) and an ED pharmacist who begin the medication reconciliation process by obtaining an accurate home medication list for each patient admitted through the Emergency Department. The home medication list is obtained through patient interview, external pharmacy records, W-10 forms from outside facilities, and phone calls to retail pharmacies or physician offices. A standardized checklist ensures that every team member performing the MRT role is following the same process and helps to reduce errors or omissions. MRTs also verify the patients allergies, height and weight, preferred pharmacy, and primary care physician. Following standardized guidelines, each patients home medications are electronically entered into the patients chart, making them readily available for the admitting physician to reconcile when writing admission orders.

Results: Within the first year of the program, medication reconciliation technicians have seen over 15,000 patients in the Emergency Department, averaging 260 patients each week. The medication reconciliation technicians spend an average of 20 minutes per patient documenting home medications, which includes interviewing the patient and/or family, calling pharmacies or physicians, and entering information into the electronic health record. Prior to implementation of the medication reconciliation technician program, paper-based medication histories were only ~54% complete, often missing medication strengths or frequencies. Ongoing quality review of the work done by medication reconciliation technicians has found a 96% accuracy rate in

obtaining and documenting home medication lists. In comparison, the overall accuracy and completeness rate of home medication lists documented by other healthcare providers, including nurses, physicians, and mid-level practitioners, is approximately 66%.

Conclusion: An emergency department-based medication reconciliation program, staffed by pharmacy technicians and a pharmacist, is an effective way to obtain accurate, complete home medication lists for patients admitted to the hospital.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost-effectiveness of Aripiprazole Versus Olanzapine as Adjunct Therapy for Treatment Resistant Major Depressive Disorder

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Purpose: Major depressive disorder (MDD) is a prevalent disease and treatment resistance to first line therapies is common. While there is a general consensus about first line therapy for MDD, pharmacologic options for treatment resistant MDD are plagued by limited, often conflicting evidence. Second generation antipsychotics (SGA) are increasingly used as adjunct therapy in MDD, but little data on their cost-effectiveness exists. We sought to determine whether aripiprazole, Symbyax, or olanzapine was the most cost-effective therapy in patients with treatment resistant depression (TRD).

Methods: We created a decision-analytic model to estimate the cost-effectiveness of adjunct aripiprazole 2-20mg/day, adjunct generic olanzapine 3-12mg/day, and fixed-dose Symbyax (olanzapine 3-12mg/day and fluoxetine 25-50mg/day) in patients with treatment resistant MDD. The analysis was performed from the perspective of the third-party payer in the United States health care system. The time horizon for the analysis was 6 weeks of care. Effectiveness was based on the percentage of patients who displayed a clinical response at 6 weeks, as defined by a 50% reduction in the Montgomery Asberg Depression Rating Scale (MADRS) score. Additional cost inputs included the cost of physicians visits, patient non-response, discontinuation, and pharmacologic management of side effects. The cost-effectiveness is reported as cost per responder, and when comparing medications, an incremental cost-effectiveness ratio is reported as cost per additional responder. Sensitivity analyses were performed for a variety of variables, including drug costs, cost of a physicians visit, clinical response rates, discontinuation rates, and adverse drug effect rates.

Results: The overall effectiveness was similar between adjunct aripiprazole and olanzapine (32.9% vs. 32.4%). The rate of discontinuation was higher in patients taking olanzapine than aripiprazole (25.3% vs. 14.7%). The overall cost of care was highest in the aripiprazole arm (\$745). Symbyax was slightly cheaper (\$663) and generic olanzapine provided the least expensive cost of care for 6 weeks (\$197). Generic olanzapine was associated with the lowest cost per responder (\$609). Symbyax and aripiprazole had similar costs per responder, at \$2045 and \$2263, respectively. For aripiprazole, it would cost the third-party payer \$16,958 per

additional responder compared with Symbyax, and \$113,666 per additional responder compared with generic olanzapine. Generic olanzapine was the most cost-effective SGA, and remained the most cost-effective option after performing a series of sensitivity analyses.

Conclusion: Generic olanzapine was the most cost-effective SGA as adjunct therapy for patients with treatment resistant MDD. Aripiprazole should only be considered in patients who are unable to tolerate therapy with adjunct olanzapine.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of pharmacists' interventions on medication adherence and clinical outcome in human immunodeficiency virus patients

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Purpose: Successful human immunodeficiency virus (HIV) treatment depends on patient adherence to antiretroviral therapy (ART). Suboptimal adherence can lead to virological failure, the development of HIV drug resistance, and possibly death. The purpose of our study is to evaluate the impact of pharmacists interventions on HIV-infected patients adherence, their knowledge of medication regimen, and clinical outcome.

Methods: HIV-infected patients with ART at Far Eastern Memorial Hospital were eligible for study participation if they were 20 years of age or older. Specialist pharmacist would provide study participants medication education on HIV regimen tailored to patient level of understanding and their needs. Study participants were then followed up by specialist pharmacist over a 6-month period to monitor their medication adherence, patient knowledge and adverse effects. Patient knowledge is calculated using a questionnaire with eight true or false questions. Adherence was assessed using medication possession ratio (MPR), and patient-self report. The MPR is defined as the number of days supply patients received divided by the number of days in the 6-month period.

Results: From March 2012 to May 2013, a total of 99 patients were eligible for study participation, with 62 patients agreed to study participation. The results showed that pharmacist intervention improved adherence. MPR with pharmacist intervention increased from 99.58% to 100%, but has no statistical significance ($p=0.32$). Pharmacists intervention reduced the number of patient that were non adherent to their medication from 0.61.2 per month at baseline to 0.10.3 per month by the end of the study ($p=0.017$) and improved patients knowledge of disease state and medication regimen (2.04 vs. 1.13, $p<0.001$). The mean CD4+ lymphocyte counts increased from 353.81 176.15 cells/mm³ to 489.97186.04 cells/mm³ ($p=0.002$) with pharmacist involvement. The numbers of patients who achieved plasma HIV RNA viral load less than 40 copies/mL also increased (26 vs. 38, $p=0.021$) over the 6-month period. Dyslipidemia (26.6%), gastrointestinal intolerance (23.9%) and central nervous system effects (20.7%) were the most common adverse effect.

Conclusion: The results demonstrated that pharmacists intervention have the potential to improve patient adherence rate, clinical outcome, and patient understanding of their disease state and medication regimen. This means that pharmacist have a major role as part of the health care for HIV patients.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost-analysis model for inpatient anticoagulant treatment in the hospital setting

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Purpose: Rivaroxaban was approved by the US Food and Drug Administration in 2011 and is the only oral factor Xa inhibitor used to: (1) reduce the risk of stroke and blood clots among people with non-valvular atrial fibrillation (NVAf), (2) treat and reduce the risk of recurrence for deep vein thrombosis (DVT), (3) treat and reduce the risk of recurrence for pulmonary embolism (PE), and (4) prevent DVT, which may lead to PE, in patients undergoing knee or hip replacement surgery. The objective of the study was to project the cost estimates from the hospital perspective for the use of anticoagulants in patients who were treated for these indications.

Methods: A hospital cost model was developed with data taken from the ROCKET-AF, the EINSTEIN-DVT and PE, and the RECORD1-3 randomized clinical trials that compared rivaroxaban with warfarin, enoxaparin plus a vitamin K antagonist, and enoxaparin alone, respectively. For the base case scenario, the distribution of hospital admissions came from the 2010 Healthcare Cost and Utilization Project (HCUP) database in which the proportion of patients discharged for each indication were the following: 24.6% NVAf, 9.3% DVT, 10.4% PE, 38.2% knee replacement surgery, and 17.5% hip replacement surgery. The proportions observed in the HCUP database were applied to an assumed hypothetical cohort of 2,000 inpatients with an admission breakdown of 492 NVAf patients, 186 DVT patients, 208 PE patients, 763 knee replacement patients, and 351 hip replacement patients. Resource utilization and cost were assumed to have come from the hospital perspective to the extent that treatment and care occurred in the hospital setting. Four cost categories (i.e., drug, monitoring, hospital stay, and administration/education) were captured in the model. Base case drug costs for rivaroxaban, enoxaparin, and warfarin represent the Wholesale Acquisition Costs (WAC) which were obtained from RED BOOK and AnalySource. Cost per hospital stay and the average length of hospital stay for NVAf and total knee and hip replacements were taken from the HCUP database and from EINSTEIN trials for DVT and PE. Shorter lengths of stay by 3 days and 1 day were observed in the EINSTEIN DVT and PE trials, respectively for patients treated with rivaroxaban compared with enoxaparin plus a vitamin K antagonist. Cost analysis of switching from current standard of care treatment to rivaroxaban was performed by taking the difference in the costs of treatment and care of hospitalized patients receiving enoxaparin, warfarin, or the combination

and those receiving rivaroxaban across all approved indications. All costs were adjusted to 2012 dollars.

Results: An overall potential saving of over \$1.7 million (\$871/patient) was observed among all patients who switched to rivaroxaban for the indications. The main driver of the hospital cost savings came directly from the reduction in the length of stay in the DVT and PE treated patients, which contributed to over 85% of the potential savings. The cost saving as a percent of total cost before switching was most impactful for DVT and PE (approximately 40% and 17%, respectively) due to both a decrease in the costs for drugs and reduction in the length of stay. Cost savings were also observed (\$41,052) for both knee and hip replacement surgeries, driven by differences in medication costs. NVAf was the only indication in which the cost was marginally higher ($< 0.1\%$; \$5.50/patient) for patients switching to rivaroxaban.

Conclusion: From an inpatient perspective, rivaroxaban provided cost-savings to the hospital based on the results of this cost-analysis model. This model integrated clinical trial data and hospital-specific cost that decision-makers may use to help inform the selection of drugs that can offer the best value and care for patients.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Alvimopan, a peripherally acting mu-opioid receptor antagonist, is associated with reduced costs after radical cystectomy economic analysis of a phase 4 randomized, controlled trial

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Purpose: Radical cystectomy for bladder cancer is frequently accompanied by complications related to delayed gastrointestinal (GI) recovery, including extended hospital length of stay (LOS) and increased risk of postoperative ileus (POI)-related morbidity. A recent phase 4 randomized clinical trial, in which patients received either alvimopan or placebo immediately before surgery and twice daily for up to 7 postoperative days, demonstrated that alvimopan accelerated time to GI recovery and reduced postoperative LOS by 2.6 days compared with placebo ($P=0.005$). An economic analysis conducted alongside the clinical trial evaluated the relative costs of alvimopan treatment compared with placebo in patients undergoing radical cystectomy.

Methods: A planned cost-consequence analysis was performed using the modified intent-to-treat population ($N=277$). Resource utilization data were collected to reflect important aspects of GI and surgical recovery and morbidity including LOS, procedures, medication use, and hospital readmission, were collected prospectively during the trial; patients were followed for up to 30 days (7 days) after discharge. Analysis was performed for the protocol hospitalization time period (from date of surgery until date of discharge) and for the protocol hospitalization plus follow-up time period to capture utilization through study completion or early termination/discontinuation. Estimated costs from the hospital perspective were based on 2012 Medicare reimbursement rates (diagnosis-related groups 654 and 655) and medication wholesale acquisition costs. Each inpatient day was weighted to reflect variation in daily cost throughout the course of hospitalization. Mean POI-related costs (hospital LOS, study drug, nasogastric tubes, POI-related concomitant medication, POI-related readmissions) and total costs (POI-related, laboratory, electrocardiograms, non-POI-related concomitant medication, non-POI-related readmission) were compared between groups using Wilcoxon Rank-Sum tests. Bootstrapping was employed to generate 95% confidence intervals (CIs) around the differences in base case mean costs to account for non-normal cost distributions.

Results: Alvimopan was associated with significantly reduced POI-related resource utilization compared with placebo including fewer days in the hospital and fewer nasogastric tube

procedures ($P<0.001$). For the period including protocol hospitalization and follow-up, the use of medications or interventions likely intended for the diagnosis or management of POI were lower in the alvimopan cohort compared with the placebo group, including total parenteral nutrition (10% alvimopan vs. 25% placebo; $P=0.001$), simethicone (8% vs. 18%; $P=0.021$), bisacodyl (25% vs. 35%; $P=0.088$), and Gastrografin (4% vs. 10%; $P=0.062$). Mean total combined costs during the protocol hospitalization, including the cost of alvimopan, were \$2,333 lower in the alvimopan group compared with the placebo group (\$15,855 vs. \$18,187; 95% CI for difference: \$4,624, \$301; $P=0.042$). When the follow-up period was taken into account, the mean total combined costs were \$2,640 lower among patients in the alvimopan group compared with the placebo group (\$18,087 vs. \$20,726; 95% CI for difference, \$5,506, \$7; $P=0.068$). Mean POI-related costs were lower for the alvimopan group compared with the placebo group during protocol hospitalization (difference, \$2,331; 95% CI: \$4,580, \$339; $P=0.041$) and for the period including protocol hospitalization and follow-up (difference, \$2,340; 95% CI: \$4,613, \$342; $P=0.040$).

Conclusion: Alvimopan resulted in cost savings for patients recovering from radical cystectomy compared with placebo. The reduction in cost was primarily driven by shorter LOS during the protocol hospitalization, which resulted in nearly \$2,640 lower costs per patient. These positive clinical and economic outcomes support the use of alvimopan within routine clinical perioperative pathways for radical cystectomy patients.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost effectiveness and budget impact of daptomycin versus linezolid for the treatment of adult vancomycin resistant enterococcal (VRE) bacteremia: a hospital perspective

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Purpose: The purpose of these analyses is to determine both the cost effectiveness and the budget impact of using daptomycin or linezolid for the treatment of bacteremia caused by vancomycin resistant enterococci (VRE) in adult patients. Currently, there is clinical uncertainty as to which agent is the most cost effective treatment option and no budget impact analyses (BIAs) have been published relating to the financial implications for the budget holder. These analyses aim to provide hospitals with more clinical and economic insight toward the most appropriate antibiotic for the initial treatment of VRE bacteremia.

Methods: After performing a comprehensive literature search, a decision analysis tree was created using clinical and economic inputs derived from studies with the greatest validity and strength. The patient population that was analyzed included both immunocompromised and nonimmunocompromised patients with a diagnosis of VRE bacteremia. Clinical inputs included rates of mortality, cure, and adverse drug events for each respective medication. Economic inputs included the costs of medications and daily costs of hospitalization per patient from the hospital's perspective. The inputs used in the decision analysis were then incorporated into a flexible budget impact analysis model in order to allow end users to change each input individually to quickly determine the budget impact from a specific hospital's perspective. The primary outcome was an incremental cost effectiveness ratio (ICER). In the BIA, risk adjusted probabilities for each scenario were used to determine the overall patient cost for the treatment of VRE bacteremia. A sensitivity analysis was performed for both treatment options evaluating the relationship between the daily cost per patient and the associated annual savings.

Results: The decision analysis model revealed that linezolid treatment was associated with a cost of 59,842 dollars per hospital stay with a 70 percent average cure rate, while daptomycin treatment was associated with a cost of 91,962 dollars per hospital stay with a 66 percent average cure rate. Thus, linezolid was dominant in the analysis. The cost of treatment for VRE BSI was driven largely by hospital length of stay. Based on published epidemiology, an average of 2.4 patients annually per hospital need treatment for VRE BSI. Based on this assumption and probability adjusted average costs per treatment for each arm, VRE BSI treatment would annually cost the hospital 218,561 dollars with initial daptomycin treatment compared to 144,165 dollars with initial linezolid treatment. Overall, the BIA supported the use of linezolid over

daptomycin as the primary agent for treatment of adult VRE BSI. The initial use of linezolid resulted in savings of 30,998 dollars per patient and 74,395 dollars annually with respect to daptomycin. Results from the sensitivity analysis showed an increase in these annual savings as the daily cost per patient increased.

Conclusion: The cost effectiveness and budget impact analyses provide information that can be helpful for hospital administrators and budget holders to make formulary decisions to more efficiently utilize their available funds. Both analyses support the use of linezolid for initial treatment of VRE BSI. Based on the BIA model's assumptions, the use of linezolid over daptomycin for initial treatment yielded a substantial savings of 30,998 dollars per patient. However, cost is only one consideration for decision makers when choosing the most appropriate agent that is both safe and efficacious for a specific patient.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Development of the Five Ps of pharmacy assessment

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Purpose: Students may struggle to apply critical assessment skills with traditional teaching methods when presented with patient cases throughout their professional education and advanced practice training. The Five Ps of pharmacy assessment tool is designed to guide students when analyzing the assessment component in the SOAP process. It consists of Patient, Prescription, Pharmacokinetics, [drug therapy] Problems, and Prevention. Our objectives were to develop and validate this tool through feedback from practicing pharmacists and pharmacy faculty to aid in the teaching and learning of the SOAP process in patient evaluation.

Methods: This continuous quality improvement study was designed to garner professional feedback regarding a newly developed tool to aid students in the patient assessment section of the SOAP process. The Five Ps assessment tool and a seven-item questionnaire were sent to practicing pharmacists and clinical pharmacy faculty, as separate cohorts, using the university's continuing education network. Pharmacist survey questions consisted of demographics, amount of work experience, preceptor experience, and a series of questions designed to gain feedback on the application of the tool for students in their practice. The faculty survey consisted of questions related to practice site, educational experience, and a series of questions to gather their opinions on the application of the tool in educating professional pharmacy students. At the end of both surveys, there was an open response section to obtain feedback on the strengths and opportunities for improvement. Participation in these surveys was voluntary and responses were anonymous.

Results: Of the pharmacists surveyed (n=149), 52% agreed the tool would be helpful to their practice, 92% agreed that it would be easy to learn, and >77% would recommend the tool to newly licensed pharmacists and P2-P4 students, while less believed the tool will be helpful for P1 students (58%). Comments highlighted its concise algorithmic structure, easy implementation in practice, plus suggestions for improving tool efficiency due to the lack of time in some practice areas. Of faculty respondents (n=12), 85.8% were supportive of this tool as an adjunct educational technique to improve the teaching and learning process related to patient assessment section in SOAP. Seventy-one percent agreed that the tool would be easy to learn and 85.7% agreed it would be easy to teach. In addition, 71% agreed that this would likely improve student competence (62.5%), confidence (87.5%) and efficiency (62.5%) in thorough patient assessment. Comments from faculty included strengths such as the algorithmic approach of the tool, an effective supplement method in the therapeutics course, and utility for P4 rotations in an easy to

remember mnemonic. Suggestions for improvement included wording modifications and concern regarding potential confusion integrating the tool.

Conclusion: Based on survey results, there is positive support by practicing pharmacists and clinical faculty for the Five Ps of pharmacy assessment tool as an adjunct method for the assessment portion of the SOAP process. Pharmacists were very supportive of this tool for educational purposes, but cautioned that it may be too time intensive in practice. Pharmacy faculty were also supportive of this tool, but suggested that it may need to be further simplified for novice students. A study evaluating the effectiveness of this tool has been developed to determine any benefit from the professional pharmacy student perspective.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of clinical decision support systems on the nephrotoxic medication prescription

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Purpose: It is clinical important to modify nephrotoxic medications dose in the renal impairment patient in order to improve therapeutic efficacy and prevent unnecessary adverse event. In our hospital, there is clinical decision support system(CDSS) warning dose modification based on the patients creatinine clearance(CrCl) and its impact on the patient care explored in this study.

Methods: For 6 months, from January 1, 2012 to June 30, 2012, the prescription pattern changes were analyzed among outpatient population with the first CDSS warning but also have been treated with the same medications in the previous 6 months in terms of prescription change rate, appropriate dose modification rate, renal impairment degree, medication class, warning CrCl criteria, prescription change rate based on the patients CrCl and medications warning CrCl range difference.

Results: Total patient numbers was 361 cases. Prescription change rate was 13.3%(48/361), appropriate dose modification rate was 77.8%(14/18) among total prescription change cases. When dose modification was not made in the 236 from 313 patients, the difference between nephrotoxic medications warning CrCl and patient CrCl was less (or equal) than 10. Prescription change rate based on the renal impairment degree was 7.4%(13/175) in the mild cohort, 18.5%(31/168) in the moderate group, and 22.2%(4/18) in the severely impaired patient group respectively. This change rate was statistically significantly increased according to the patients renal function deterioration (p value = 0.006) and antimicrobial medication class was related with the highest change rate in the analysis per medication class. If warning CrCl criteria was high, prescription change rate was statistically low (p value = 0.01) but when the difference between patient CrCl and medications warning CrCl range was high, change rate was statistically high (p value = 0.001).

Conclusion: Based on these result, after the implementation of CDSS renal function module, 13.3% of total prescription in this patient population were modified and remaining 75.4% of unchanged prescription seems to be made based on the physicians clinical decision considering target medications CrCl margin in conjunction with patients remaining renal function. In the

future, implementation of advanced CDSS which even can suggest appropriate medication dose will be necessary based on the patients renal function and medications renal safety margin.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Potential budget impact of integrating taliglucerase alfa therapy for Gaucher disease in the United States

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Purpose: Gaucher disease (GD) is the most prevalent of the lysosomal storage disorders and is caused by mutations in the gene encoding the enzyme glucocerebrosidase with an estimated prevalence of 1 in 40,000 to 1 in 50,000. Treatment involves enzyme replacement therapy (ERT), and 3 ERTs are currently available: imiglucerase, velaglucerase alfa, and taliglucerase alfa. Taliglucerase alfa is a plant cell-expressed beta-glucocerebrosidase approved for ERT in adults with type 1 GD. Potential advantages of the plant-cell production platform include rapid production scalability, improved safety, and reduced cost. The purpose of this analysis was to estimate the potential budget impact of integrating taliglucerase alfa therapy for GD treatment in the USA.

Methods: A budget impact model analysis was performed, based on the total estimated number of GD patients treated, drug wholesale acquisition costs, and market share of the 3 available ERTs. Drug costs in USD per 200-unit vial were based on wholesale acquisition costs in the ReadyPrice and Medi-Span databases. Annual costs were calculated using the number of vials required including wastage and were rounded up to the nearest vial. Actual cost savings may vary with factors beyond drug acquisition costs, such as rebate programs, and may not necessarily reflect the actual cost paid by consumers, pharmacies, or third-party payers.

Results: The number of GD patients treated with ERT in the USA was estimated to be 3,000. Taliglucerase alfa has the lowest drug acquisition cost among the 3 available ERTs: The drug costs for 200 units of taliglucerase alfa, velaglucerase alfa, and imiglucerase were 595 USD, 675 USD, and 793 USD, respectively. Annual costs per patient are estimated at 328,440 USD, 372,600 USD, and 437,736 USD for taliglucerase alfa, velaglucerase alfa, and imiglucerase, respectively. If all GD patients were switched to taliglucerase alfa, annual savings would be up to approximately 200 million USD for the US healthcare system overall. For a plan with 50 GD patients, assuming the same market share as the national average, switching to taliglucerase alfa could save up to 4 million USD annually. On a per-patient basis, the savings could be up to 100,000 USD annually. Because many GD patients in the USA are still untreated, use of taliglucerase alfa could allow for about 700 more patients to be treated annually, if the national ERT budget were unchanged.

Conclusion: Taliglucerase alfa has the potential to provide a cost-saving alternative to other ERTs for GD. Although clinical studies have not directly compared the safety and efficacy of

taliglucerase alfa with imiglucerase and velaglucerase alfa, taliglucerase alfa has been found to be safe and effective in adult and pediatric patients with GD. Based on the demonstrated clinical efficacy, the reduced cost and the plant-cell production platform that is not vulnerable to mammalian viral contamination and has supply flexibility due to rapid production scalability, taliglucerase alfa may offer potential benefits as compared to other available ERTs.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Re-measuring satisfaction among residents in ASHP-accredited pharmacy residency programs

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Purpose: Results published by VanDenBerg and Murphy in the late-1990s surveyed satisfaction among ASHP-accredited pharmacy residents. In this national survey, pharmacy residents indicated levels of satisfaction associated with various internal and external factors such as hours worked, and perceived meaningfulness of work. Since then pharmacy residency programs have evolved along with advancements in preceptor development, shifting supply and demand for post-graduate programs, and new factors motivating pharmacy students to pursue residency. The purpose of our research was to reassess the current level of work satisfaction for pharmacy residents.

Methods: An electronic survey in-part duplicating the previous satisfaction survey was sent to the residency program directors of a total of 1585 residencies with ASHP pre-candidate, candidate, or accredited status, with a request to forward to current residents. Participants were asked to answer questions on a series of measures, including demographics, residency program time commitment and a 16-item satisfaction questionnaire with responses represented on a 5-point Likert scale of agreement. Satisfaction questionnaire items 14, 15 and 16 were general statements of overall satisfaction with the residency program, and were combined to create a summary satisfaction score which was categorized for multivariate ordinal logistic regression analysis. A score of 8 or less was termed Dissatisfied, 9-10 Neutral 11-13 Satisfied and 14 or greater as Very Satisfied. Covariates in the analysis included interest in a PGY2 residency, age, hospital size, residency program size, extra-curricular job, hours worked and participation in an on-call program. Inclusion criteria for covariates in regression analysis was either a α value ≤ 0.3 , or by substantive knowledge of the investigators. A final parsimonious model was selected based on model fit by likelihood ratio and Bayesian information criterion. All analyses were performed in STATA SE 12 (Statacorp, TX).

Results: Seven hundred twenty-seven completed responses, accounting for approximately 28% of the current resident population, were analyzed. A majority of respondents were in PGY-1 Pharmacy Practice Residency Programs (71%, n=516), female (70%, n=509) and unmarried (72%, n=525) with a mean age of 27 years. Item responses from this survey were nearly identical to previous data reported by VanDenBerg and Murphy. Multivariate analysis including only PGY1 respondents had 70% higher odds of being satisfied if respondents stated an interest in pursuing a PGY-2 residency (OR 1.7, 95% CI: 1.1-2.4).Controlling for other variables, age

≥ 30 years was associated with a 40% lower odds of being satisfied (OR 0.6, 95% CI: 0.4-0.9). Residents from a program with an on-call component had 60% lower odds of being satisfied (OR 0.4, 95% CI: 0.3-0.7). Residents who worked longer hours had lower odds of being satisfied (OR 0.96, 95% CI: 0.95-0.98).

Conclusion: We performed a survey of pharmacists in ASHP-accredited residencies to determine overall resident satisfaction in these programs. Although the internal and external factors affecting pharmacy residency training have changed, no significant increases or decreases in overall satisfaction were noted. Among residents in PGY-1 Pharmacy Practice residency programs, an interest in PGY-2 residency training was associated with increased likelihood of being satisfied. Further, decreased satisfaction was associated with increasing age, being in a program with an on-call component, and working longer hours.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Correction of the international normalized ratio and in-hospital mortality among patients with warfarin-related major bleeding: an analysis of electronic health records

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Purpose: Warfarin is associated with a substantial risk of major bleeding and fresh-frozen plasma is often required for correction of blood clotting as measured by the International Normalized Ratio (INR). There are limited data on the relation between the timing of correction of INR and in-hospital mortality among patients presenting with warfarin-related major bleeding, or on the threshold to use for correction.

Methods: A retrospective database analysis was undertaken with electronic health record data from a large integrated health system, using data from 01/2004 through 01/2010. Patients were selected based upon the following criteria: major hemorrhage diagnosis (intracranial hemorrhage [ICH], gastrointestinal [GI], or other, termed Non-ICH); $\text{INR} \geq 2$ on the day before or day of receipt of fresh frozen plasma (FFP); and prescription fill for warfarin 90 days prior to or during the hospitalization episode. INR correction was primarily defined as ≤ 1.5 and alternatively as ≤ 1.3 in order to account for varying practice patterns. In-hospital mortality was analyzed, and KaplanMeier curves were constructed to assess median days and hours to INR correction, censoring for death.

Results: 354 patients met cohort selection criteria (mean age 75 years, 53% male). 120 patients (34%) experienced an ICH major bleed, of which 93% of patients achieved $\text{INR} \leq 1.5$ and 79% achieved $\text{INR} \leq 1.3$ during the hospital stay. Among patients experiencing a non-ICH major bleed ($N=234$, 66%), 86% and 64% achieved $\text{INR} \leq 1.5$ and ≤ 1.3 during the hospital stay, respectively. Among those who corrected during the hospital stay, median days to $\text{INR} \leq 1.5$ was the same by bleed type (1 day), but was significantly longer for non-ICH vs. ICH bleeds when defining correction as ≤ 1.3 (3 vs. 2 days, $P<.001$). In a subset of patients with hourly time-stamp data available ($N=62$ for $\text{INR} \leq 1.5$, $N=45$ for $\text{INR} \leq 1.3$), median hours to $\text{INR} \leq 1.5$ and ≤ 1.3 were longer for non-ICH vs. ICH bleeds (≤ 1.5 : 23 vs. 16 hours; ≤ 1.3 : 35 vs. 26 hours, respectively). For both bleed types, a greater proportion of patients whose INR was never corrected died during the hospitalization versus those who corrected for $\text{INR} \leq 1.5$ (ICH: 56% vs. 15%; non-ICH: 12% vs. 2%) and $\text{INR} \leq 1.3$ (ICH: 40% vs. 13%; non-ICH: 5% vs. 3%).

Conclusion: In this analysis of EHR data for patients presenting with warfarin-associated major bleeding, our findings suggest that the majority of patients achieve INR correction during the

hospital stay. Time to INR correction, however, differs by bleed type with non-ICH patients taking longer to correct to $\text{INR} \leq 1.5$ or 1.3 than ICH patients. For both bleed types, in-hospital mortality appears to be higher for patients who never achieve INR correction compared to those who corrected, and also varies by INR threshold with higher mortality for patients corrected to $\text{INR} \leq 1.5$ vs. $\text{INR} \leq 1.3$.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Implementation and evaluation of an automated prior authorization program in a county health system

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Purpose: Prior authorization programs (PAP) are a cost effective approach in shifting use from more costly agents to cheaper formulary alternatives. Cost savings are an ongoing issue in healthcare today. A prior authorization program has been in existence in a county facility for over a decade, with initially less than ten agents and has grown to include 84 pharmaceuticals. The call volume is approximately 12,300 calls annually with 75% physician and 85% pharmacy compliance with the approved guidelines. The primary goals for transitioning to an automated prior authorization process were to decrease call volume, increase compliance and pharmacy workflow efficiency.

Methods: The prior authorization program began an automated restriction pilot program in EPIC pharmacy software on October 15, 2012. The following four agents were chosen for the pilot program: duloxetine, esomeprazole, insulin glargine, and montelukast based on the frequency of calls received for these agents. The automation pilot allowed providers to select the PAP criteria in EPIC instead of calling as well as provided alternatives. The criteria were approved by the Pharmacy and Therapeutics Committee and Medical Board. If the patient does not meet the listed criteria, the prescriber must contact the PAP physician on call for approval. The compliance with the PAP criteria of the four agents was assessed as well as before and after automation was compared.

Results: After 3 months of the automated PAP program, 1343 new prescriptions were written for the four selected agents. Approximately 56% (1010/1343) of the charts were reviewed of which the overall PAP compliance rate was 75.2% (760/1010). The most common reason for noncompliance was when providers selected that patients were going to a non health system pharmacy while the patients actually filled the prescription in house (26%, 65/250). The second most common reason for noncompliance was when providers selected the option that approval was given by the physician on call (27.2%, 68/250). Compliance with PAP criteria improved for insulin glargine (50% to 72%) and duloxetine (73% to 86%) in the three months as compared to the previous year but decreased for montelukast (87% to 81%) and esomeprazole (87% to 65%). The average call volume of 1025 per month decreased to 648 calls per month during the piloted period.

Conclusion: The majority of noncompliance stemmed around nonclinical reasons. The pharmacy and therapeutics committee are considering how to develop a mechanism to prevent prescribers from circumventing the process in this manner. Additional agents will be added to the pilot based on cost, utilization and safety. The success of the pilot program will continue to be monitored for at least a year.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of the blockbuster generics on a county hospital budget

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Purpose: Blockbuster drugs, defined as drugs that generate more than \$1 billion in revenue, have been losing their patent exclusivity at a rate higher than any other time in the history of generic drugs. This phenomenon has been dubbed the patent cliff and includes Lipitor, Plavix, Seroquel, Singulair, Actos, Zyprexa and Lexapro. These seven drugs accounted for almost \$33 billion in revenue in 2011. The purpose of this study was to evaluate the impact of these generics on a county hospital system budget.

Methods: This retrospective study was conducted utilizing data from Harris Health System Department of Pharmacy for the period of December 2011 to December 2012. The top 7 blockbuster drugs identified using the US Pharmacist top 200 products of 2011 by total dollars. The number of prescriptions and the dollar spend on these drugs at county hospital system was identified. The dollar spend for 6 months post generic availability was compared with 6 months prior to the generic availability on the US market. The effect of generic utilization of prescribing pattern was evaluated.

Results: As our institution is covered by 340b pricing, the branded product for olanzapine was less expensive than the generic version for the first three months then the generic product became less expensive. The total savings attributable to the availability of olanzapine was \$79,293.84. Atorvastatin which was previously restricted to use after simvastatin failure was unrestricted when it became available as a generic product which increased its use in the health system and produced a cost savings of \$109,077. Like olanzapine, the branded product for atorvastatin started out being less expensive than the generic for the first three months of the generic being on the market. The introduction of generic escitalopram had a negligible impact on the budget at the health system as it is not currently on the formulary. The generic version of quetiapine led to a cost savings of \$58,099 and the availability of the generic clopidogrel yielded the largest cost savings at \$450,078. There was a modest cost savings of \$510 associated with montelukast was limited as montelukast is restricted to patients who have failed zafirlukast and limited purchases in the first six months of the generic product availability. We did not purchase pioglitazone in this time frame.

Conclusion: Blockbuster generics offered a great cost savings to health systems across the country. It has saved our health system over \$610,000 in the first six months of each product becoming available generically.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Clinical and cost effectiveness of bupivacaine liposome injectable suspension in a community hospital setting

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Purpose: Bupivacaine liposome injectable suspension (BL) was approved in October 2011 for the management of postsurgical pain. Compared to conventional bupivacaine injection, BL has a substantially longer duration of action (up to 72 hours), but is significantly more expensive. The potential for safety issues related to medication handling (due to similarities in appearance to propofol) have been raised for BL. The primary purpose of this retrospective cohort study was to assess the potential cost tradeoffs associated with use of BL in a real-world community hospital setting. Secondly, we assessed the clinical effectiveness and safety of BL compared to a historical comparator.

Methods: This study protocol was approved by our institutional IRB. The BL cohort (n=18) included adult patients (18-89 years) that received BL at a single community hospital between October and December 2012. A historical control cohort (n=365) was identified through query of electronic databases and included all patients (18-89 years) with similar DRG groupers to the BL cohort, but prior to introduction of BL at our institution (January to September 2012). Key outcomes assessed included total direct costs, length of stay, and elastomeric pump utilization. Opioid use and pain scores were collected for 72 hours postoperatively.

Results: Percent female patients (72 versus 59%) and mean age (64 versus 60 years) were slightly higher and length of stay was slightly lower (6.4 versus 7.3 days) in BL patients versus control. Total direct costs were similar between BL and control patients. The difference between actual and expected total costs for the same DRG by the same surgeons was approximately \$315 lower for BL patients compared to historical controls. Use of BL was also associated with a substantial reduction in the use of elastomeric pumps (0% versus 22%). PCA use was higher with BL compared to control (83 versus 77%). No significant issues related to medication handling were identified for BL and no patients in either cohort required naloxone for reversal of opioid-related adverse events.

Conclusion: Use of BL in a community hospital setting was not associated with higher overall medical costs. Other non-pharmacy costs, including use of elastomeric pumps, may be important when considering the cost effectiveness of novel therapies like BL. Medication handling concerns with BL are manageable with appropriate staff education.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Patterns of anticoagulant use and rates of recurrence among patients with incident venothromboembolism managed in US hospitals: a multi-center electronic health record study

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Purpose: Venothromboembolism (VTE) treatment guidelines from the American College of Chest Physicians recommend initial parenteral and/or oral anticoagulation therapy for acute DVT or pulmonary embolism, and at least 3 months of therapy to prevent recurrence. This study was undertaken to assess anticoagulant use, treatment patterns and recurrence rates among hospitalized patients treated for incident VTE across multiple US health systems.

Methods: Patients hospitalized with a new VTE event between 2008 and 2012 were identified using VTE ICD-9-CM diagnosis codes from the Humedica database. This database provides integrated de-identified electronic health record data from geographically-diverse providers for approximately 10 million patients in the United States. To further confirm the presence of an acute VTE event requiring medical management, eligible patients were required to have received anticoagulant treatment for at least two days and/or undergone a VTE-related procedure (e.g., Greenfield filter, embolectomy, thrombolysis). Qualifying anticoagulants included parenteral anticoagulants (defined as low molecular weight heparin [LMWH], unfractionated heparin [UF] or fondaparinux) and warfarin. The first VTE diagnosis date served as the index date. Patients were excluded from the study if they: (1) did not have a medical encounter in the six-month period prior to index date (baseline period); (2) had a prior diagnosis of VTE or used anticoagulants in the baseline period; or (3) had a diagnosis of atrial fibrillation, atrial flutter, cardiomyopathy or a coagulation disorder anytime during baseline or up to one year after index date (follow-up period). Recurrent VTE events, defined as hospitalizations meeting the same confirmation criteria as the index VTE event, were evaluated among patients during the follow-up period.

Results: Data from 2,060 patients hospitalized with VTE were analyzed (mean age 60.9 years, 53.0% female, 58.8% white, 76.5% from academic centers, 17.6% with cancer). Mean (SD) length of stay of index hospitalization was 8.1 (8.6) days, with 21.3% of patients using the ICU. Most patients (89.1%) had their VTE diagnosis on admission to hospital. Acute DVT was the most common VTE event (41.9%) followed by PE (33.3%) with the remaining sample having both DVT and PE (24.7%). Almost all patients (1196, 96.9%) received anticoagulants during hospitalization, with only 64 treated by procedure without anticoagulants. Among patients

receiving anticoagulants, 1,942 (94.3%) patients received some form of heparin (30.6% received LMWH alone, 28.6% UF alone, and 40.8% UF with LMWH), and 1,575 (76.5%) had warfarin therapy during index hospital stay. Almost all patients (98.5%) who received warfarin also received a heparin and/or fondaparinux. Although 1,219 (78.1%) of warfarin users had warfarin prescribed at discharge, only 633 (40.2%) had a warfarin prescription within 30 days of hospital discharge. Overall 30 day, 90 day and 1-year VTE recurrence rates were 2.04%, 4.21% and 7.51%, respectively.

Conclusion: This study found that in a real-world population of hospitalized patients with incident VTE, treatment with heparin in conjunction with warfarin was very common. However, continuation of warfarin therapy outside of the hospital setting was challenging, considering the majority of patients with acute VTE did not have evidence of warfarin treatment in the outpatient setting within 30 days of discharge. Initiatives to improve continuation of anticoagulant therapy after hospital discharge may be important to reduce VTE recurrence rates.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of pharmacist involvement in the transitional care of high-risk patients through medication reconciliation, medication education, and post-discharge callbacks

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Purpose: Transition between settings is associated with significant incidences of adverse effects. Previous data suggest pharmacist interaction with patients, through medication reconciliation, discharge counseling, and post-discharge phone calls, improves patient knowledge regarding their medication regimens, and decreases adverse drug events (ADEs). Literature suggests pharmacists play a positive role in transitional care from the inpatient to outpatient setting; however the impact on readmission rates has not been described. This study's objective is to determine if pharmacist intervention would decrease medication errors (MEs) and ADEs, decrease Emergency Department (ED) visits, decrease 30-day all-cause readmissions and improve patients' perception related to communication about medications.

Methods: In this prospective, randomized study, patients admitted to two medicine units who provided informed consent were enrolled if identified as high-risk. High-risk was defined as patients discharged on greater than or equal to four scheduled prescription medications and/or a high-risk medication (anticoagulants, anti-diabetics, immunosuppressants, anti-infectives). The following outline exclusion criteria: failure of Mini-Cog Screening, no phone, non-English speaking, elective readmission within 30 days, three admissions in the previous two months, discharged to a facility, caregiver managed medications, discharged within 24-hours, and discharged against-medical advice or before medication education. Three hundred and forty-two patients were randomized to study or control groups. Control patients received the current standard of care and were called 30 days post-discharge to assess MEs and readmissions. Study patients received a pharmacist medication consultation, which included complete medication history, medication reconciliation, discharge counseling, and post-discharge phone calls at 3, 14, and 30 days. Outcomes assessed include number of MEs and ADEs through 30 days post-discharge, ED visits, hospital readmission rates and improvement in HCAHPS scores for the medication knowledge domain. It was determined that a sample size of 150 patients in each group will provide 80 percent power to demonstrate a 20 percent improvement medication errors.

Results: Patients who received at least one phone call were included in the study analysis. Of the 314 patients who qualified, 175 were controls and 139 were study patients. Fifty-six patients

were lost to follow-up with 41 from the control arm and 15 from the study arm. The percent of ED visits, inpatient readmissions, and combined inpatient readmissions/ED visits was higher in all three categories in the control group (15.7 percent, 22.4 percent, 38.1 percent, respectively) than the study group (4.0 percent, 21.0 percent, 25.0 percent, respectively). This was statistically significant for both the ED visits and combined inpatient readmissions/ED visits (p value less than 0.05). Of the 26 study patients who experienced inpatient readmission, 10 did not receive any post-discharge phone calls. The number of ADEs at the 30 day phone call was 11 in the control group and 9 in the study group. The number of MEs at the 30 day phone call was 7 in the control and 1 in the study group. The difference in HCAHPS scores for the medication knowledge domain was not significant for both units combined (P value=0.15).

Conclusion: Pharmacist intervention was effective in decreasing ED visits and all-cause readmissions. This supports the importance of pharmacists participation in face-to-face medication reconciliation, transitional care medication discharge education, and post-discharge follow-up. In contrast to previous literature, the impact of early follow-up after discharge by a pharmacist was effective in improving patient outcomes. The HCAHPs scores were not largely impacted, likely due to the few number of study patients that received and completed surveys. As medication regimens become more complex and greater attention is focused on reimbursement based patient outcomes, this study supports the impact of pharmacists on transitions between care settings.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost-utility analysis of albumin-bound paclitaxel versus paclitaxel as second-line therapy in HER2-negative patients with metastatic breast cancer

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Purpose: Nanoparticle albumin-bound paclitaxel (nab-paclitaxel) is a relatively new chemotherapeutic agent approved in 2005 for use in metastatic breast cancer (MBC). National Comprehensive Cancer Network guidelines for MBC recommend paclitaxel as a preferred agent and nab-paclitaxel as a potential agent. Phase II and III studies have shown a decrease in paclitaxel-related toxicities with the albumin-bound formulation, but at increased acquisition costs. The purpose of this study was to evaluate the cost-utility of paclitaxel formulations in a hypothetical cohort of HER2-negative patients with metastatic breast cancer who have failed prior anthracycline therapy, using a third-party payer perspective over 2.5 years.

Methods: A cost-utility analysis was performed using a Markov model comparing nab-paclitaxel 260 mg per square meter without corticosteroid and/or antihistamine premedication versus paclitaxel 175 mg per square meter with premedication, each administered in 3-week cycles. Subjects in the model moved between three health states: MBC without progression, MBC progression, and death. Progression-free survival and overall survival used in the model were derived from a Phase III randomized trial directly comparing the two agents. Costs for each comparator were obtained from large US-based analyses of third-party and Medicare claims data. Costs of treatment included office visits, procedures, chemotherapy, hospitalizations, and ancillary treatment due to adverse drug events. All costs were adjusted to reflect 2012 US dollars. Utility values for treatment, progression, and adverse events were derived from previously published literature. One-way sensitivity analyses were performed to account for uncertainty with model inputs, which were varied over the plausible range of values. A probabilistic sensitivity analysis was performed using a Monte Carlo simulation. The model was used to calculate the expected total costs and quality-adjusted life years (QALY) gained with each treatment, as well as the incremental cost-effectiveness ratio (ICER).

Results: The base case analysis found a total treatment cost of \$79,055 and \$94,382 with paclitaxel and nab-paclitaxel, respectively. Treatment with paclitaxel increased QALYs by 0.30 versus a 0.53 QALY gain with nab-paclitaxel treatment. The resulting ICER of nab-paclitaxel versus paclitaxel was \$64,744 per QALY. The ICER was most sensitive to the costs and utility scores associated with the nab-paclitaxel treatment arm. The Monte Carlo simulation revealed a median ICER of \$92,959 per QALY (95 percent CI, \$54,535 per QALY to \$140,182 per QALY)

with 64.1 percent of the ICERs falling below the \$100,000 per QALY willingness to pay threshold.

Conclusion: Nanoparticle albumin-bound paclitaxel presents a reasonable alternative to paclitaxel as monotherapy in patients with metastatic breast cancer who have failed prior anthracycline therapy. Third-party payers should consider covering nab-paclitaxel as well as paclitaxel for MBC. Additionally, providers should offer nab-paclitaxel therapy as an option along with paclitaxel, and discuss with the patient the tradeoffs between improved efficacy, reduced adverse events, and increased costs. The main limitation of this study was a lack of available literature directly comparing the efficacy of nab-paclitaxel and paclitaxel, and future economic analyses will be needed once more literature becomes available.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of consolidation of satellite pharmacies on medication expenditures and waste

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Purpose: Hospitals have historically established pharmacy satellites to locate pharmacy staff and medications closer to patient care areas in order to facilitate drug distribution and clinical services. Pharmacy satellites can also be associated with higher costs because of the need to maintain a separate inventory of pharmaceuticals. An academic medical center in New York City made the decision to consolidate two of their pharmacy satellites into one satellite in order to decrease redundant storage and decrease the amount of waste resulting from expired medications. Data on drug procurement and value of expired medications was measured comparing annual period during the project with the annual period immediately prior to consolidation.

Methods: In the first quarter of 2012, the Department of Pharmacy decided to consolidate operations of the burn unit pharmacy satellite with another pharmacy satellite. This was accomplished in a stepwise approach. The technicians and medication stock were first transferred to the remaining pharmacy satellite. The burn unit pharmacy satellite remained open to be utilized as a distraction free environment for order verification by pharmacists. The other pharmacy satellite was utilized as the central location for medication dispensing for both satellites. The institution then reviewed the purchasing data for these satellites for the annual period immediately before and after consolidation. The department also tracked the value of expired medications generated by the pharmacy satellites for the same time periods.

Results: Pharmaceutical expenditures declined 26 percent in the year following pharmacy satellite consolidation, resulting in an expense reduction of \$370,000. The value of expired medications retrieved from the pharmacy satellites declined 9.7 percent, resulting in an expense reduction of \$13,400.

Conclusion: The consolidation of the two pharmacy satellites was effective in reducing pharmaceutical expenses and expired medications.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost-effectiveness analysis of acupuncture versus topiramate for migraine prophylaxis

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Purpose: There is significant economic burden associated with chronic migraine management. Subsequently, medication overuse can further the development of chronic migraines. Middle aged females are prone to chronic migraines and are candidates for prophylactic therapy to decrease disruptions to daily life. Use of prophylactic therapy can reduce the use of rescue therapy minimizing costs. Topiramate is one of the current standards of therapy for migraine prophylaxis used to improve quality of life and decrease rescue therapy use. Comparatively, studies using acupuncture also show benefits with treatment. This cost-effectiveness model looks at the outcomes of topiramate versus acupuncture for migraine prophylaxis.

Methods: Data used for the one-year Markov Model were gathered from various published sources. The model inputs utilized costs for acupuncture, topiramate, and triptans (rescue therapy). The inputs also included efficacy of acupuncture and topiramate in preventing the migraine. Costs of hospital visits accrued as a result of adverse drug reactions (ADR) from triptan use were applied as well. The analysis was conducted based on a one-year model and was conducted from the societal perspective.

Results: The incremental cost-effectiveness ratio for acupuncture compared with topiramate (ICER) was \$74,003/QALY. A one-way sensitivity analysis compared a range of acupuncture treatment costs to the median cost of topiramate (\$5.00 per day). It was found that acupuncture and topiramate therapy were equally efficacious at a cost of \$5.83 per day for acupuncture (\$41 per session). Any value below the \$5.83 per day cost threshold represented the area where acupuncture was more efficacious while any value above the \$5.83 per day cost showed topiramate to be a better value. A two-way sensitivity analysis was performed comparing the cost of acupuncture and topiramate. Results showed that acupuncture was a cost-effective option for migraine prophylaxis only when the cost of topiramate exceeded \$1.35 per day. Below that threshold, topiramate is the dominant treatment option.

Conclusion: Determining a cost-effective treatment option for migraine prophylaxis in middle-aged females with chronic migraines varies depending on the patient-specific cost to obtain topiramate. This analysis suggests that when the price of topiramate exceeds \$1.35 per day,

acupuncture is a cost-effective option based on an economic evaluation from a societal perspective.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Seasonal influenza: cost and utilization associated with rapid influenza diagnostics tests in an insurance claims database

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Purpose: The purpose of this study is to assess the healthcare cost and utilization associated with seasonal influenza. This study evaluates the management of seasonal influenza in current clinical practice with an emphasis on evaluating the use of Rapid Influenza Diagnostic Tests (RIDT). Additionally, factors associated with the use of anti-influenza medications for the treatment of influenza are examined. The study evaluates how the use of RIDTs in influenza management impacts healthcare utilization and cost.

Methods: In this retrospective study, investigators extracted claims data from the Blue Cross/Blue Shield of Nebraska (BCBSNE) insurance claims database. Using appropriate CPT, ICD-9, and GRI billing claim codes which indicate influenza, investigators identified episodes of influenza like illness which occurred between September 1st, 2011 and March 1st, 2013. The identifying codes for episodes of influenza like illness were codes for the following: the diagnosis of influenza, diagnostic tests for influenza, and dispensed medications for the treatment influenza. The investigators also obtained the weekly influenza surveillance data for the state of Nebraska which was collected during the period of time evaluated in the study. Investigators grouped subjects into those with episodes of influenza who had a claim for an RIDT, those who had a claim for a diagnostic test not defined as rapid, and those patients having claims for an influenza diagnosis and/or treatment with an anti-influenza medication with no diagnostic test claim. Trends in clinical practice were analyzed and a cost analysis was performed. The cost analysis was based on the allowed amount of reimbursement as reported in the billing claims for each episode.

Results: This study captured 15855 episodes of influenza like illness. Diagnostic tests were used in 11245 episodes and RIDTs in 9184 or 57.9% of episodes. The 2012-2013 season had greater flu activity than the 2011-2012 season which was reflected in the study data and state surveillance data. The number of RIDTs was 6935 in the 2012-2013 flu season and 2249 in the 2011-2012 season. The frequency of RIDT per episode was 55.4% in the 2012-2013 flu season and 67.3% during the 2011-2012 season. We found that 26.6% of subjects receiving an RIDT had a claim for treatment with an anti-influenza prescription. Of episodes documented without an RIDT, 82.6% of episodes had a claim for a treatment prescription. The study found that there were 2945 claims for treatment prescriptions without a diagnosis or diagnostic test. This represented 43.8% of the total claims for treatment prescriptions. The cost analysis found that

there was a statistically significant lowered cost in episodes in which diagnostic testing was employed. The mean direct medical cost for an episode with diagnostic testing was \$153.10 while the mean cost without diagnostic testing was \$218.89 per episode. The mean cost for each episode with an RIDT was \$140.52.

Conclusion: The use of RIDTs is associated with decreased utilization of anti-influenza medications. The cost analysis demonstrated that the use of diagnostic testing in the management of seasonal influenza is correlated with statistically significant direct healthcare cost reduction. The cost analysis showed that cost reduction is even greater when RIDTs are used as opposed to diagnostic tests not defined as rapid. The results of this study support the use of RIDTs in clinical practice due to the associated reduction in healthcare costs and utilization.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost effectiveness analysis of aclidinium vs. tiotropium for treatment of COPD from a third party payer perspective

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Purpose: To conduct a cost effectiveness analysis from a third party payers perspective comparing aclidinium bromide 400mcg twice daily versus tiotropium bromide 18mcg once daily in patients over the age of 40 with chronic obstructive pulmonary disease.

Methods: Decision analytic model followed a cohort of patients over 24 weeks. Population was modeled based on two clinical efficacy trials with patients receiving either aclidinium 400mcg twice daily or tiotropium 18mcg once daily. Patients could either remain in a controlled disease state or have an exacerbation, which could be treated either inpatient or outpatient depending on the severity. The model outcome was dollars spent per symptom-free weeks. The probability of having an exacerbation on either therapy was varied using sensitivity analyses.

Results: Aclidinium therapy proved more cost effective during a 24-week model than tiotropium therapy. Aclidinium therapy cost \$2,211 for 24 weeks of treatment and yielded 23.93 symptom-free weeks. Tiotropium therapy cost \$3,147 for 24 weeks of treatment and yielded 23.87 symptom-free weeks. Aclidinium therapy dominates with its lower costs and better outcomes from the third party payer perspective. Sensitivity analysis revealed that aclidinium loses dominance if a 34.6% probability of exacerbation exists.

Conclusion: As long as the probability of having an exacerbation remains low and the costs for these medications remains the same, aclidinium therapy is more cost effective than tiotropium for the treatment of COPD in patients 40 years or older. Aclidinium is a new product on the market and changes in the cost associated with each of these therapies must be taken into account in the future.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Establishing an internal medicine clinical pharmacy practice in a community non-teaching hospital: early economic outcomes

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Purpose: Traditional clinical pharmacy services, such as inpatient rounding, are less commonly available in smaller community hospitals. The justification of a high-cost position, capturing cost avoidance data, and convincing unfamiliar prescribers of the need for clinical pharmacy services are all barriers to expanding into smaller institutions. With the advent of the Pharmacy Practice Model Initiative and the growing demand for pharmacy residencies, it is imperative that data becomes available to help overcome the barriers to clinical pharmacy service implementation. This study aims to quantify the economic impact of an internal medicine clinical pharmacists recommendations during inpatient rounds on overall drug expenditures.

Methods: Beginning in 2011, a newly formed internal medicine clinical pharmacy service was established at a facility with limited pharmacist-physician rounding prior to its implementation. All accepted interventions were documented electronically. In order to quantify the economic impact of the new service, physician-specific drug expenditure data was analyzed from January 1, 2011 to December 31, 2011. Any internal or family medicine practitioner with at least 15 admissions over the course of the year was included in the analysis. The primary endpoint was the difference in mean total drug expenditures per discharge between the physicians rounding with a pharmacist versus those physicians without pharmacy presence on rounds. Secondary outcomes included types and frequencies of pharmacist interventions and a comparison of drug expenditure data for 8 of the most common diagnoses encountered on the internal or family medicine services. Data was analyzed using the students t-test, Mann-Whitney U test and descriptive statistics, where appropriate.

Results: A total of 1,656 clinical pharmacist interventions were accepted over the course of the year. The most common interventions included therapeutic recommendations (32.6%), adverse event avoidance (19.3%), drug information (19.1%), dose adjustment (13.2%), cost savings recommendations (8.5%), and ordering additional laboratory tests (7.4%). The 5 physicians in the intervention group discharged 1049 patients compared to 1959 discharges for the 10 physicians in the control group. The difference in total drug expenditures per discharge between the intervention and control groups was \$127.20 (\$285.00106.22 versus \$412.2060.38, $p=0.01$). When data was examined for each of the most common disease states encountered, drug costs for pneumonia patients were significantly reduced in the intervention group (\$320.21313.20 versus \$503.64385.81, $p=0.006$). Total drug expenditures for sepsis, COPD, heart failure, myocardial

infarction, renal failure, urinary tract infection, and cerebrovascular accident were all reduced in the intervention group but did not reach statistical significance.

Conclusion: The implementation of an internal medicine clinical pharmacy practice resulted in a significant reduction in total drug expenditures when compared to other internal and family medicine practitioners in a community hospital setting. Sub group analyses of the most common diagnoses encountered demonstrated similar findings. The addition of a clinical pharmacist to the control group physicians could potentially bring about a \$558,414.69 savings in drug expenditures annually, more than enough savings to justify the additional positions necessary to cover all inpatient services.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Pharmacy students improving medication safety across transitions of care through an interprofessional medication reconciliation collaborative process in a rural hospital

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Purpose: Medication errors can occur at interfaces of change. As patients with multiple medical conditions have different providers, the complexity of their medication regimen pose a threat to medication safety. Medication reconciliation is a process of accurately comparing the patients medication orders with what they have been previously taking and resolving any discrepancies to avoid medication errors. Pharmacists and pharmacy students can assist with providing accurate and complete medication records. This project was designed to evaluate the improvement in medication safety by documenting medication errors occurring in the medication reconciliation process through the collaborative efforts between medicine, nursing, and pharmacy.

Methods: A retrospective review was conducted on complex patients medication reconciliation forms completed by pharmacy students as part of their advance pharmacy practice experience in April 2013. Complex patients included those with an admission diagnosis of congestive heart failure, chronic obstructive pulmonary disease, non-ST segment elevation myocardial infarction, or pneumonia. Nurses initiate the medication list electronically in the emergency department and review through the hospital stay. Physicians and medical residents resume patients home medications as necessary for their admission and electronically reconcile medications upon discharge. Pharmacy students can assist nurses and physicians in this process by interviewing complex patients or their caregivers, or gathering medication information from their community pharmacist or primary care provider and updating the medication reconciliation form. Any discrepancies such as omissions, duplications, dosing issues, or drug interactions between the admission form and the updated form were noted and resolved with the hospitalist or medical residents. Each discrepancy was then documented in the hospitals pharmacy software (Clinical Measures) by the pharmacist preceptor. The primary endpoint includes the number of medication errors identified by pharmacy students in the medication reconciliation process and dollars saved as a result. The secondary endpoint includes the specific types of medication errors identified.

Results: A total of 29 medication reconciliation forms were reviewed in the month of April 2013. A total of 118 medication errors were identified by pharmacy students and addressed during this collaborative effort. Based on these documented interventions, \$30, 516 were saved. Out of the 118 medication errors identified, there were 79 drug omissions, making it the most common medication error through the admission medication reconciliation process. There were also 30 dosing issues, 5 duplicate therapies, 3 chart review (2 adverse drug reactions; 1 no home medications), and 1 drug interaction.

Conclusion: Through the medication reconciliation process, pharmacists and pharmacy students working in collaboration with other healthcare professionals can improve medication safety across the continuum of care. In rural communities where resources are limited, pharmacy students play a vital role in complementing nurses as well as physicians initiatives in the medication reconciliation process of complex patients. Better documentation of these interventions during this process can ensure appropriate patient care as well as save healthcare dollars. As this study was conducted in a small rural hospital, further studies will be needed to focus on readmission rates and greater their associated economic outcomes.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Conversion from metered dose inhalers to a vibrating mesh nebulizer in long term acute care hospitals: cost effectiveness and respiratory staff perception

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Purpose: The administration of aerosol medications to mechanically ventilated patients can be accomplished through the use of propelled Metered Dose Inhalers (pMDI) or by different methods of nebulization. Due to the escalating cost of pMDI therapy and the discontinuation of some pMDI products, a system of Long Term Acute Care Hospitals (LTACHs) specializing in the care of patients with Chronic Critical Illness (CCI) evaluated the use of a vibrating mesh nebulizer (Aerogen Aeroneb Solo) to provide a more cost effective therapy and an alternative to newer soft puff MDIs that are incompatible with ventilators.

Methods: System wide utilization of pMDIs containing ipratropium with or without albuterol was evaluated by pharmacy leadership. It was determined that 13 of the 112 hospitals utilized 56 percent of pMDIs, but only accounted for 16 percent of the patient days. These high utilization facilities used pMDIs over standard small volume nebulizers (SVNs) in ventilated patients. The respiratory therapy staffs preference for pMDIs generally aligned with at least one of the following reasons: infection risk caused by opening the circuit for administration, extra air flow that causes the ventilator to alarm or alter the breathing pattern, or felt less medication would reach the patient due to particle size. An in-line vibrating mesh nebulizer was subsequently introduced to these facilities as an alternative to MDIs. Each site was trained on the system and began converting pMDI patients to nebulizer treatments. Data on total treatment cost was compared before implementation (July-December 2011) of the vibrating mesh nebulizer to an equivalent period the following year (July-December 2012). An institutional review board exception was obtained for a retrospective review of available quality data. Following the 6 month implementation window the respiratory therapy staff was surveyed on their satisfaction with the system and the implementation process.

Results: When compared to the same 6 month period the prior year, the use of the vibrating mesh nebulizer reduced acquisition cost of medication and materials related to albuterol/ipratropium therapy by 65 percent. This represents a shared net savings of \$222,500 for the 13 hospitals over 6 months. The savings for the pharmacy at the individual site level was a 1.4 percent to 5.8 percent decrease in the drug budget over the 6 month period. Following the 6 month period 69 percent of the respiratory therapists were very satisfied with the system while 3

percent were dissatisfied or very dissatisfied. The survey also found that 83 percent of the respondents considered the vibrating mesh nebulizer the most effective way to administer aerosol medications.

Conclusion: The conversion of a historically pMDI administering hospital to a nebulizer can be facilitated with the coordination of pharmacy and respiratory therapy. A change in normal practice can be accomplished with little dissatisfaction from the staff affected by the change. The use of nebulized solutions can be a more cost effective alternative to the escalating cost of pMDI products and resolve issues with ventilator incompatibility of newer soft puff MDIs.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Resource utilization and costs in a US commercially insured population with schizophrenia

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Purpose: Schizophrenia (SCZ) is a serious public health concern and is a leading cause of disability. While the prevalence of SCZ is relatively low in the commercially insured population, SCZ treatment costs are disproportionately high. The current study provides an up-to-date descriptive analysis of the SCZ population for commercial insurers including: (1) a snapshot analysis of resource utilization and costs (including prescription drug) per patient per month (PPPM); and (2) a longitudinal analysis of resource utilization and costs over 24 months, including antipsychotic and other psychiatric medication use over time, for newly diagnosed patients with SCZ.

Methods: Two retrospective analyses using the Truven Health MarketScan 2007-2011 commercial claim data files were performed: an annual snapshot of patients with newly diagnosed and chronic SCZ using 2011 as the index year, and a longitudinal analysis of patients with newly diagnosed SCZ using 2008 and 2009 as index years with a 24-month prospective follow-up period. Included individuals were 13-64 years old, had ≥ 2 SCZ codes on medical claims during the index year, and were continuously enrolled for 12 months prior to index. For the longitudinal analysis, patients were also required to be continuously enrolled for 24 months after index. All claims were grouped by inpatient, outpatient, professional, and prescription drug categories. The claims were further segmented by SCZ, other psychiatric, and non-SCZ/nonpsychiatric claims.

Results: For the snapshot analysis, 8985 patients with SCZ met the inclusion/exclusion criteria (newly diagnosed, n=2827; chronic, n=6158; mean enrollment of 11.5 months). Mean PPPM was \$1806 vs. \$419 per member per month for a demographically adjusted commercial population. Mean PPPM cost was \$2182 for newly diagnosed, and \$1608 for chronic patients. Annual inpatient admission rate was 636/1000 patients with SCZ vs. 48/1000 for a similar commercial population. Patients with SCZ had an annual ER rate of 2270 visits/1000 patients vs. 158 visits/1000 members for a similar commercial population. For the longitudinal analysis, 1902 patients with newly diagnosed SCZ were identified. Highest costs were in the index month (average cost, \$6601; 70% due to inpatient). Costs declined to \$1635/month for months 2-6, \$1456/month for months 7-12, \$1324/month for months 13-18, and \$1218/month for months 19-24. In the index month, 58% of patients had an antipsychotic claim, 71% during months 2-6, 66% during months 7-12, 63% during months 13-18, and 61% during months 19-24.

Antidepressant and anticonvulsant use was high: 34% and 27% of patients, respectively, had a prescription claim in the first month, increasing to 44% and 36%, respectively, after 2 years.

Conclusion: Patients with SCZ represent a disproportionately high share of total costs, given the relatively small prevalence in this commercially insured population. The costs for patients with SCZ are 4 times higher per patient on average than average commercially insured patients with matched demographics. Costs were highest in the index month, largely driven by inpatient costs. Further claims data analyses investigating patterns of care, drug therapy adherence patterns, and barriers to medication adherence among patients with SCZ are warranted to improve the quality and to impact the cost of care for patients with SCZ.

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Costs and discontinuation associated with antipsychotic monotherapy versus antipsychotic polypharmacy in patients with schizophrenia in a commercial claims database

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Purpose: In the treatment of schizophrenia (SCZ), current clinical practice commonly involves combining antipsychotics (APs) to improve treatment of patients with suboptimally controlled symptoms, despite the lack of robust evidence for this approach, the increased risk of side effects, and the cost implications [Leucht et al., 2011; Honer et al., 2006]. The purpose of this analysis was to compare total health care cost, resource utilization, medications, and discontinuation among patients with schizophrenia (SCZ) receiving AP monotherapy versus those receiving AP polypharmacy.

Methods: We examined commercial claims from 01/01/2007 to 04/30/2010 using the HealthCore Integrated Research Database. Patients (n=4156) 13-64 years old with ≥ 2 claims for schizophrenia and treated with AP medications (second generation and/or first generation) were identified and followed for 1 year. Therapy groups were categorized as: AP monotherapy (1 antipsychotic: n=3188; 77%) and AP polypharmacy (2+ antipsychotics: n=968; 23%). Total annual costs of all medical and pharmacy claims were calculated. Costs were described with means, medians, and standard deviations (SD) for all patients in the sample as well as for the subset of patients in each cost category that had any costs. Because of the highly skewed data (many patients in each cost category without any claims), differences in mean costs for the whole sample were gamma transformed and compared with a log-link function. Differences in mean costs for those who had any costs were compared with t-tests. Persistence on AP treatment was defined as percentage discontinuing by 3, 6, and 12 months (defined as a ≥ 90 -day gap in treatment of at least 1 AP). Chi-square tests were used to compare proportions of patients discontinuing.

Results: Compared with patients receiving monotherapy, polypharmacy patients had significantly higher ($P < .001$) mean total annual all-cause costs (monotherapy: \$19,319 \$30,287 vs polypharmacy: \$31,264 \$39,869) and higher ($P < .001$) mean total annual costs even when excluding APs (monotherapy: \$16,316 \$30,164 vs polypharmacy: \$25,550 \$39,999). Inpatient services accounted for 39% of annual costs among monotherapy patients and 45% among polypharmacy patients. Compared with monotherapy patients, more polypharmacy patients had at least 1 inpatient stay (monotherapy: 32% [n=1027] vs polypharmacy: 50% [n=480]) and nearly double the rate of readmissions (monotherapy: 14% [n=436] vs. polypharmacy: 23%

[n=222]). Among patients who had any inpatient admissions, the inpatient-stay mean cost was significantly higher in the polypharmacy group compared with monotherapy (\$27,496 \$43,624 and \$21,433 \$37,966, respectively; $P = .015$). The majority of patients discontinued their index AP prior to the end of the 1-year follow-up (77% of AP polypharmacy patients vs. 53% of AP monotherapy patients). Fifty percent of AP polypharmacy patients discontinued their AP regimen (1 or more APs) prior to 3 months vs 17% of AP monotherapy patients. In both groups, discontinuation was highest among patients <26 years old compared with the older age groups.

Conclusion: Patients on polypharmacy have higher costs and discontinuation rates. Persistence with AP therapy is low among all patients, especially among younger patients and patients on polypharmacy. Patients on polypharmacy seem to have more severe SCZ, which could in part account for these differences. However, the higher rate of readmission (more than 1 mental health-related inpatient stay) among polypharmacy patients suggests polypharmacy may have limited efficacy and needs to be weighed against the comorbidity and cost burdens.

Category: Preceptor Skills

Title: Assessment of introductory pharmacy practice experience (IPPE) student reflections as evidence of achievement of Accreditation Council for Pharmacy Education (ACPE) core competencies

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Purpose: Introductory pharmacy practice experience rotations provide the foundation for the development of advanced pharmacy practice experience (APPE) skills and competencies. The Accreditation Council for Pharmacy Education outlines eleven pre-APPE core domains with example performance competencies. Student learning outcomes corresponding to these domains were listed as course goals and objectives in the students' introductory rotation syllabus; however the students did not receive formalized training regarding the competencies. This project was designed to review introductory pharmacy practice students' weekly written reflections to document achievement of these competencies during the students' community and institutional introductory rotations.

Methods: A total of 291 students completed a weekly written reflection during each of the (2) required four week IPPE rotations, resulting in a total of over 2300 reflections. Students completed rotations in the community and institutional settings. Student reflections were reviewed by faculty members of the Office of Experiential Education, using a standardized pre-APPE core competency checklist which corresponded to the eleven pre-APPE core domains. Student activities which resulted in the achievement of performance competencies in the areas of patient safety, basic patient assessment, medication information, drug related problems, pharmaceutical calculations, ethical, professional and legal behavior, communication abilities, counseling patients, drug information and literature research, public health and insurance/prescription drug coverage were identified. In addition to the eleven core domains, interprofessional interactions between pharmacy students and other health care disciplines were also included in the checklist. There were a total of six faculty members who participated in the review process. Each faculty member was randomly assigned to review weekly reflections for approximately 48 students and results were compiled in an excel database.

Results: While students had the opportunity to achieve performance competencies in all core domains in the institutional and community settings, similarities and differences were noted between the achievement of these domains and rotation type. Patient safety was identified as the core domain where students had the most numerous opportunities to achieve performance

competencies in both the institutional and community introductory rotation settings. Students participated in activities associated with patient safety and the accurate dispensing of medications multiple times throughout each rotation type. Ethical, professional, and legal behavior ranked second following patient safety in both the institutional and community settings in terms of the average number of performance competencies achieved by each student. Students had more opportunities to practice their communication skills, counseling skills, and knowledge of prescription drug coverage and public health in the community rotation setting. This was balanced by students having greater opportunities to use skills associated with drug information and literature research, patient assessment, and pharmaceutical calculations in the institutional setting. Opportunities for interprofessional interactions, solving drug related problems, and demonstrating knowledge of medication information were similar in the institutional and community settings.

Conclusion: Adjunct faculty preceptors offered introductory rotation students a variety of clinical experiences in both institutional and community settings, which directly resulted in the achievement of pre-APPE performance competencies. These performance competencies provide the basis for the development of advanced rotation skills and competencies. Overall, students had numerous opportunities to participate in activities related to each core domain, which reinforced the students' knowledge and understanding of the pre-APPE core domains and their associated competencies. While these students were participating in introductory rotations, many successfully participated in clinical activities that are often reserved for advanced pharmacy practice students.

Category: Preceptor Skills

Title: Undergraduate students' perception of the pharmacy profession post implementation of a pharmacy seminar honors course

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Purpose: Most undergraduate students have no concept of the pharmacy profession while others may only have pre-conceived stereotypes of it. Pre-pharmacy programs lack student exposure to the profession, leading some to feel unprepared and uninformed upon entering pharmacy school. An elective course was created for a group of pre-pharmacy, honors college students to expose them to pharmacy. Selected pharmacists and pharmacy students were invited to discuss specific topics and provide information about the profession. The study objective was to determine if attending the pre-pharmacy course had an impact on the students' perception of pharmacy.

Methods: Students enrolled in a one credit hour elective pre-pharmacy course. An anonymous 31 question survey was administered the first day of class to assess baseline knowledge of the profession of pharmacy and the career opportunities. The survey captured students demographics, educational background, previous pharmacy experience, and pharmacy career interests. Further, it asked questions to determine the extent of their knowledge of the pharmacy profession, e.g., pharmacy laws, career options in pharmacy, pharmacy certification, political issues in pharmacy, qualities and challenges of a pharmacist. Students rated themselves as weak, fair, good, or very good in terms of knowledge of career choices in pharmacy, understanding where the profession fits in health care, self-confidence upon entering into pharmacy school, and the strength of their feelings to apply to pharmacy school. In addition, the survey evaluated the students perceptions whether a pharmacist must possess the following qualities to be successful in their career: networking, communication, organization/committee work, and volunteer work. At the end of the 15-week course, a retrospective pre-post, anonymous survey was administered to determine whether the course influenced the students perception of the pharmacy profession. Descriptive analyses were utilized. The study was evaluated and approved by the Institutional Review Board.

Results: Of the fifteen students enrolled in the course, fourteen responded to both pre and post-surveys, i.e., 93% response rate. In the pre-survey, 43% knew what a pharmacy residency was compared to 57% who did not, versus 93% and 7%, respectively, post-survey. When students were asked where a pharmacist would work upon graduation, 58%, 16%, and 26% stated hospital pharmacy, retail pharmacy, or other, respectively. After completing the course, 42% stated hospital and 11% responded retail; interestingly, 47% indicated residency, research, or clinical pharmacy as other post graduate options. Only 7% were able to list 5 pharmacist disease

state specialties in the pre-survey, versus 64% in the post-survey. Students were asked to rate their knowledge of pharmacy career choices initially with 38% selecting fair; compared to 69% answering very good post-survey. The students confidence level in entering pharmacy school was weak (54%) in the pre-survey versus good (54%) post-survey. Twenty-three percent versus 54% of students agreed to apply for pharmacy school admission when comparing the pre-survey and post-survey respectively. Of note, before the course started, 15% were not interested in applying to pharmacy school. However, upon completing the 15 week course, none of the students stated this.

Conclusion: An increased exposure to the pharmacy profession via a pre-pharmacy course demonstrated a benefit for students to learn more about the profession. The course helped to address questions students may have had, e.g., career options, expectations in pharmacy school, future position opportunities, expectations of pharmacists. Early exposure to the pharmacy profession can be crucial in recruiting and retaining interested undergraduate students who are unsure about a pharmacy career. A pre-pharmacy course teaches students about the pharmacy profession and may motivate them to pursue a career in pharmacy.

Category: Preceptor Skills**Title:** Factors influencing applicants' selection of residency training programs**Primary Author:** Katy L Garrett, University of Kentucky College of Pharmacy, 789 S. Limestone, Lexington, KY, 40536, United States; Email: klgarrett@uky.edu**Additional Author(s):**

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Purpose: Selecting a pharmacy residency program can be a daunting task for applicants, given the array of programs and competition for positions. We sought to elucidate the factors pharmacy residents considered when applying to and ranking specific residency programs, as well as measures of their satisfaction with the programs they eventually chose. In doing so, we aimed to guide applicants during their residency program pursuit, as well as identify features residents valued most to assist program directors in their recruitment processes.

Methods: The institutional review board approved this study. Post-graduate year 1 (PGY1) and post-graduate year 2 (PGY2) pharmacy residents in a single state were emailed a questionnaire that evaluated their residency program selection choices. On a five-point scale (1=not at all important, 5=extremely important), participants rated the importance of more than 25 characteristics in several broad categories (e.g., employment requirements, job outlook, reputation, demographics) they used to apply to, interview with or rank residency programs. The top five characteristics that ultimately led to their residency selection, as well as the five program characteristics they favored most and least as current residents, were also noted. Satisfaction with their current residency program was then elicited through four agreement questions. Results were aggregated and analyzed to determine the most prevalent characteristics as well as the mean rating each characteristic received, from which standard deviations were calculated.

Results: Of the 58 possible survey participants, 36 chose to participate (62%), 75% of which were postgraduate year one residents. 75% of respondents were female and 85% planned to pursue a career in clinical pharmacy. For the residency characteristics used during their search and selection process, residents most commonly listed: geographic location (50%) with an average ranking of 4.11 1.30; reputation of residency program (41.6%) with a ranking of 4.330.93; and type of institution conducting the residency (41.2%) with a ranking of 4.440.97. Reflecting on their actual experience as residents, participants noted the features they currently valued most were: geographic location (38.9%;4.11 1.30) , type of institution (38.9%; 4.440.97), nature of on-call program (36.1%; 3.41.22), ability to work with specific patient populations (33.3%; 4.31.80), and reputation of the residency program (33.3%; of 4.330.93). Those valued least were licensure requirements (38.9%; 2.561.08), salary (33.3%; 2.221.15), and early commitment option for PGY2 (33.3%; 2.721.56). Agreement with the statement If I were to do it all over again, I would use the same selection criteria to select a residency program was high, with a mean value of 4.50.65 and 80% indicating either agreement or strong agreement.

Conclusion: Residents who considered the location, institution type, and program reputation noted greater satisfaction with their ultimate program selection and residency experience. Program applicants should consider these and other factors when conducting their own residency search. Directors may increase their recruitment success by touting their program reputation through highlighting achievements of program graduates and preceptor engagement in professional organizations and scholarly activities, and enhancing practice experiences like on-call programs. Further investigations should be conducted to yield associations between specific residency characteristics, resident career goals and eventual program satisfaction.

Category: Preceptor Skills

Title: Pharmacy Residents Understanding of Biostatistics and Clinical Research

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Purpose: To determine whether pharmacy residents at a university affiliated, Veterans Affairs medical center can accurately interpret various aspects of biostatistics and research methods.

Methods: A survey of first- and second-year pharmacy residents was conducted using a previously validated 20-question test.

Results: Twenty-two participants completed the survey with a cumulative score of 53.4% (95% confidence interval [CI], 49.6 57.2). The average score for first- and second-year residents were similar (53.5% [95% confidence interval {CI}, 50.6 56.5] vs. 53% [95% CI, 33.1 72.9]; $p = \text{not significant [NS]}$). Females achieved a slightly higher score than their male counterparts (54.1% [95% CI, 50.5 57.6] vs. 51.7% [95% CI, 37.7 65.6]; $p = \text{NS}$). There was no difference in average scores with relation to age (21 25 years old; 53.6% [95% CI, 45.3 61.9] vs. 26 30 years old; 53.3% [95% CI, 48.5 58.2]; $p = \text{NS}$). Pharmacy residents excelled in identifying different types of data variables (81.8 - 90.9%), recognizing the purpose of blinding and masking (95.5%) and interpreting relative risk (95.5%) but struggled with complex analytical methods such as Kaplan Meier analysis (0%) and multivariable logistic regression model (4.5%).

Conclusion: Pharmacy residents may fail to correctly interpret biostatistics and research methods encountered in today's primary literature. Since understanding of research components is critical, it is important that pharmacy schools and residencies provide more training in these areas.

Category: Preceptor Skills

Title: Preparation and implementation of a state-wide residency preceptor development seminar

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Purpose: The refinement of teaching skills required to be a pharmacy residency preceptor is categorized as a Critical Factor by the American Society of Health-System Pharmacists (ASHP) Commission on Credentialing. However, in a report by the Commission in August 2012, 53 percent of PGY1 and 45 percent of PGY2 residency programs surveyed were cited as being partially compliant with this standard for not supporting adequate preceptor development. As residency programs grow there is an increasing need for support from state associations to develop preceptors. This project describes the implementation of a state association-led continuing education program focused on residency preceptor development.

Methods: In January 2013, thirteen of eighteen (72 percent) pharmacy residency program directors (RPDs) in Arkansas completed an online survey to determine current needs of residency programs. Preceptor development was reported as one of the top topics of interest by more than half of respondents. From the results of this survey, the plan for a state-wide preceptor development seminar was created as a collaborative effort between the Residency Council of the Arkansas Association of Health-System Pharmacists (AAHP) and a private health system with PGY1 residency programs. Continuing education topic suggestions were collected during a state-wide RPD conference call. Speakers were chosen from residency programs at varying sites with differing years of experience. Programming was scheduled for a Saturday morning to accommodate most participants schedules. Participation was solicited using electronic marketing to association members, residency preceptors, and residents. Sponsorship from AAHP allowed participants to attend and receive four hours of Accreditation Council for Pharmacy Education (ACPE) approved continuing education credit without any personal or institutional costs. Using video-conferencing, pharmacists in two additional regions of the state were able to actively participate. Topics included an overview of the residency learning system, developing a learning experience, preceptor roles and responsibilities, and delivering effective feedback.

Results: Forty-one pharmacists participated in the seminar, ten of which were not current preceptors. Twenty-eight pharmacists participated at the main education site, with thirteen participating between the two remote sites. An online survey was completed by thirty-four (82.9 percent) seminar attendees within two weeks of the seminar to evaluate the quality of the programming, the desire to continue similar programming in the future, and suggestions for further supporting pharmacy residency training around the state. All survey respondents agreed

or strongly agreed that the training program was beneficial for their precepting. Future topic suggestions included subjects such as help with publishing, preparing for accreditation visits, mentoring through the residency project, and teaching the resident to precept students. Suggestions collected for timing and location of future programming indicated that most respondents appreciated the Saturday morning time slot. Availability of off-site teleconferencing was preferable, with recommendations to broadcast from a college of pharmacy with improved technology.

Conclusion: As the number of pharmacy residencies continues to grow, the need for residency preceptor development will increase. Organizing a state-wide residency preceptor development seminar is an effective way to provide education for preceptors within a state with minimal effort from individual residency programs. Collaborating with local organizations or other residency programs to provide sponsorship removes the financial burden from the attendees and their organizations. Utilizing video conferencing allows for accessibility of the seminar throughout a region. Future plans for residency preceptor development in this state include annual programming, development of web-based modules, and increasing the number of off-site locations.

Category: Preceptor Skills

Title: Impact of a school of pharmacy regional residency/fellowship showcase on pharmacy students interest in postgraduate training

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Purpose: The number pharmacy students pursuing postgraduate training has expanded significantly in the last 5 years. MCPHS University School of Pharmacy-Boston has organized a regional residency/fellowship showcase that includes programs from the Northeast each November for the last 11 years. In 2012, there were 44 programs participating, 39 of which represented PGY 1 or PGY 2 residency programs. Students from New England area schools were invited to attend. While very well attended, the impact of this showcase on students level of interest and preparedness in pursuing post-graduate training has not been formally evaluated.

Methods: A survey instrument was developed by faculty members of the School of Pharmacy's Residency and Fellowship Committee. In addition to general demographic data, students were asked to indicate their level of interest in pursuing postgraduate training, and if so, what type of programs they are interested in applying to. The survey also asked what factors may have influenced their decision to seek a residency or fellowship, what steps they have already completed in the process of applying, and whether they also plan on attending the 2012 ASHP Midyear Clinical Meeting. For rating questions, the survey instrument used a 5 point scale, with a score of 1 being not at all and 5 being extremely high. A total of 315 students attending the showcase were invited to complete the survey, which was collected at the end of the program or completed on-line. Follow-up emails with the survey online were sent to students attending the showcase. Students completing the survey were entered into a drawing to receive a gift card. The survey was approved by the University's Institutional Review Board. Descriptive statistics were used for data analysis.

Results: A total of 247 (78%) students completed the survey. Sixty-eight percent were female and 32% were male. Seventy percent were PY4 students, 24% PY3 students and 83% were members of ASHP. While most respondents attended a pharmacy school in Massachusetts (84%), there were students from all six New England states in attendance. Most (72%) planned on attending the 2012 Midyear meeting as well. Students expressed most interest in hospital and ambulatory care residency programs, (80% and 47% respectively). Twenty-three percent of students were interested in fellowship programs. Students indicated that school of pharmacy faculty and former/current residents had the most influence on their decision to pursue a

residency. In response to the number of residency programs students intended to apply to, 48% planned to apply to 5-10 programs, and 16% to 11-16 programs. In terms of students preparation prior to the showcase, 58% had already contacted programs of interest, 73% had a CV prepared and 66% had contacted individuals to serve as references. Respondents highly rated satisfaction with the showcase in regards to helping them understand what types of programs are available and how a residency/fellowship can benefit their career, and 99% would recommend it to others.

Conclusion: A regional residency/fellowship program showcase is valued by students as they consider post graduate training opportunities. While most attending the showcase were PY4 students, many PY3 students participated as well. Interest in hospital residency programs in particular was very high. Students appeared to be preparing to begin the application process prior to the showcase and intend on applying to several programs. School faculty and former/current residents seem to have a significant influence on the decision to apply for post-graduate training. Most students also still planned on attending the ASHP Midyear.

Category: Preceptor Skills

Title: The Effect Of Preceptor Education On Time Spent In The 4 Preceptor Roles: Preceptor vs. Resident Perspectives

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Purpose: Preceptor development is an essential element for residency accreditation. During an ASHP reaccreditation survey, the VA Palo Alto Health Care System PGY1 Residency was given partial compliance for preceptors not providing sufficient narrative commentary to guide residents skill development. When commentary was provided, it was generally quantitative in nature. In response, the residency included in its preceptor development program an educational session on how to effectively use the 4 Preceptor Roles to provide qualitative feedback. The aim was to improve the quality of feedback by having preceptors utilize less Direct Instruction and more Coaching and Facilitating.

Methods: At the beginning of the 2010-2011 residency year, the 4 Preceptor Roles (i.e., Direct Instruction, Modeling, Coaching, and Facilitating) were reviewed with preceptors during a Residency Committee meeting and with PGY1 residents during their orientation. Specific examples of how the roles can be used were discussed. At the end of that residency year, preceptors and residents were surveyed to see how much time both groups perceived preceptors spent in each of these roles. Additionally, preceptors were asked to rank their ability to use these roles, and their teaching effectiveness on a 4-point Likert scale (1-Needs Improvement to 4-Excellent). Residents were asked to rank their preceptors on the same scale for their ability to use the 4 preceptor roles, and their preceptors teaching effectiveness.

Results: Of surveys sent to 20 preceptors, nine surveys were completed (45%). Of the 7 PGY1 residents surveyed, all 7 (100%) submitted their surveys. Preceptors judged the percentage of time that they spent in Direct Instruction, Modeling, Coaching and Facilitating as 13.8%, 23.5%, 26.8% and 34.6%, respectively. Residents estimated their preceptors utilized these same preceptor roles in 15%, 16%, 28%, and 41% of time, respectively. Overall, preceptors rated their ability to utilize the 4 roles of a preceptor an average of 2.9, while residents rated preceptors at an average of 3.2. Preceptors rated their teaching effectiveness when utilizing the 4 roles of a preceptor on average as 3.0, while residents rated their preceptors on average as 3.3.

Conclusion: Preceptors and residents consistently estimated that the majority of feedback was provided via coaching and facilitating roles, however residents perceived that these roles were used more often than what preceptors perceived as time spent in those roles. In comparison to preceptors themselves, residents rated preceptors higher for both their ability to utilize the 4 Preceptor Roles and their teaching effectiveness when utilizing the 4 roles. Next steps are to

share results of this survey with preceptors, to provide preceptor training on effective feedback and evaluation techniques, and to continue to survey preceptors and residents regarding preceptor development.

Category: Preceptor Skills

Title: Development of a regional teaching certificate program for pharmacy residents practicing in institutional settings

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Purpose: To develop a teaching certificate program for pharmacy residents through a collaborative effort among all the residency directors in San Diego County.

Methods: Nine San Diego County organizations offer residency programs for 55 postgraduate year one and two (PGY1, PGY2) residents annually. Residency program directors in San Diego collaborated in the design and implementation of a program aimed at improving resident the teaching skills. We conducted a literature review of existing programs to seek components that would align with our goals and fit into a yearlong program. Our program required the creation of a teaching philosophy, attending didactic lectures and workshops, and providing teaching to pharmacists and ancillary healthcare professionals. Each resident was required to provide a minimum number of teaching activities such as a formal large group presentation and small group facilitation and teaching. Each teaching activity was evaluated by the attendees using a specific evaluation form. The program was initiated in 2010 as a mandatory requirement for PGY1 residents and elective for PGY2 residents. Participants were surveyed at the completion at the program to assess satisfaction and their comfort with teaching.

Results: During the initial two years, 85% of the residents received a certificate of completion and 53% anonymously returned an end of the year survey. Responders who agreed or strongly agreed that the educational components of the program were excellent, program significantly enhanced my knowledge of teaching and precepting, program has made me an effective teacher/preceptor, program significantly enhanced my confidence/comfort level in teaching and precepting, and I would strongly encourage future residents to participate in the program were 61%, 66%, 69%, 64% and 71%, respectively.

Conclusion: The San Diego countywide Teaching Certificate Program resulted in self-reported increased knowledge and effectiveness of teaching and precepting and an increase in confidence among the residents. The teaching program continues today as a collaborative approach.

Category: Preceptor Skills

Title: Evaluation of the introduction of weekly current event discussions as a learning activity in an internal medicine advanced pharmacy practice experiential rotation

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Purpose: Learning activities on internal medicine advanced pharmacy practice experiential (APPE) rotations typically include pharmacy practice-centered activities such as attending patient care rounds, evaluating and adjusting medication treatment plans, and responding to drug information questions. Although these activities provide students with the opportunity to apply many of the principles and information they have learned in the classroom, they are often lacking in their ability to connect the students with newsworthy events that occur in the world of pharmacy and medicine that shape their present and future. Furthermore, these types of discussions are often lacking from core pharmacy school curricula. In order to fill this void and improve students awareness and appreciation of current events, weekly sessions were conducted in which each student on rotation with the preceptor identified a newsworthy current event in pharmacy and presented it to the APPE group (typically 3-4 students and the preceptor) by providing a summary of the event and describing implications for pharmacy and the general public. Current events were identified by the students in online media sites or printed newspapers. A broader discussion among the students and led by the preceptor ensued in order to gain further insight of the event. Students were also required to submit a written summary of the event with their own thoughts on how the event affected pharmacy practice. The objective of this study is to determine the importance and value of this activity on student learning based on student feedback.

Methods: A written electronic survey was prepared and students participating in APPE rotations in which the current event discussions occurred were solicited. Responses were then compiled and assessed. This study was approved by the Colleges institutional review board and students gave informed consent prior to completing the survey.

Results: Eleven of 15 students who participated in the current event discussions during the 2012-13 academic year responded to the survey invitation. Overwhelmingly (11/11), the students agreed that they enjoyed the current event discussions, with most of them (7/11; 63.5%) admitting that they were not familiar with the current events prior to our discussions. All the students agreed that the discussions helped them better understand the events and improved the students appreciation and understanding of how these events affected pharmacy. All the students agreed that following these discussions they were more likely to look for and learn about events that affect pharmacy. The students also unanimously agreed that the activity should be continued for future APPE rotations, with 6/11 students (54.5%) saying it was perfect the way it was designed and implemented, while 3/11 students (27.3%) even suggested there should be more frequent current event discussions during the 6-week APPE rotation.

Conclusion: Pharmacy students have limited formal opportunities and generally do not independently seek out and learn about current events that affect the world of pharmacy, but they value activities that enable them to identify and discuss these events. Students taking part in current event discussions are also more likely to stay connected with their external professional environment once they are made aware of these events and appreciate how these events might affect their practices.

Category: Preceptor Skills

Title: Implementation of a midyear oral examination to assess clinical competency and need for remediation in pharmacy residents

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Purpose: The American Society of Health System Pharmacists (ASHP) recommended that by 2020 all graduating pharmacists receive residency training.¹ This goal must be balanced with the maintenance of resident clinical excellence and competence in the programs available. Pharmacy residencies have few objective assessments of clinical competence of residents. Evaluations through the ASHP system Resitrak may be limited by incomplete recall and bias. Written exams mainly assess factual knowledge. The Council of Emergency Medicine Residency Directors reported previously on the importance of early identification of knowledge deficits and remediation in medical residents, with specific emphasis on minimizing personal bias and optimizing objectivity.² Additionally, successful use of oral examinations in ophthalmology residents was documented in 2008.³ Therefore, we incorporated a mid-year oral examination into our program to assess the clinical reasoning ability of our PGY1 pharmacy residents using real life clinical case scenarios. The purpose of this examination was to assess clinical competency and establish plans for remediation as needed.

Methods: In 2012, the resident advisory committee (RAC) and resident program director (RPD) designed oral examinations for the two PGY1 residents at our institution. Hillcrest Hospital is a 500-bed tertiary care facility located in a suburb of Cleveland and affiliated with the Cleveland Clinic Foundation. The oral examination was scheduled in December 2012, after three months of clinical rotations. The preceptor from each of the three clinical rotations wrote ten patient case related clinical questions that were reviewed and approved by the RPD. A total of 30 questions were asked according to each residents individual rotation experiences. The residents were given the three patient cases 24 hours before the examination. Each resident was instructed to provide a brief synopsis of the patient case at the beginning of the examination. The examination period was one hour, thus granting 20 minutes per clinical rotation. The preceptor who taught the clinical rotation asked the questions. All other preceptors observed and graded the resident based on the answers provided prior to the examination by the preceptor.

Results: Two PGY1 pharmacy residents completed the exam. Resident A had clinical rotations in internal medicine, infectious disease, and critical care. This resident passed two of the three exams, and failed the infectious disease exam. Resident B had clinical rotations in internal medicine, infectious disease, and oncology. This resident passed all three exams. The RPD and RAC then devised a remediation plan for resident A, which included another concentrated

rotation in infectious disease. The resident completed the rotation and improved her clinical skills to an acceptable level.

Conclusion: The mid-year oral examination of our pharmacy residents allowed for an objective assessment of clinical expertise while preventing memorization by the residents or personal bias from the evaluating preceptors. Additionally, this process provided insight into areas of knowledge deficit for the residents. We believe the mid-year oral examination will assure maintenance of a high level of quality for the graduates of our program.

Category: Preceptor Skills

Title: Patient perceptions and changes to lifestyle after student pharmacist-driven medication review services

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Purpose: The aim of this project was to measure patient perceptions after receiving a medication review from a student pharmacist

Methods: Student pharmacists on an advanced pharmacy practice experience (APPE) rotation performed medication review services to patients. Patients voluntarily participated in medication reviews after receiving a post card describing the medication review service. During the one hour session, students reviewed the patients medical history, reviewed all prescription and non prescription medications, and noted any significant drug related problems. Recommendations were made to patients regarding therapeutic duplication and drug-drug interactions, as well as education on adverse effects and benefits of lifestyle modification. A pharmacist preceptor was present at all appointments. A follow-up survey was mailed to the participants homes asking them to rate their experience. Post surveys were used to evaluate patients experiences and satisfaction with the medication review service. Study methods were approved by the University's Institutional Review Board.

Results: A total of 32/65 (65%) participants completed the survey. Survey results indicate that 100% (32/32) of respondents felt they have a better understanding of their medications after participating in the medication review session. Of the patients who responded, 68.75% (22/32) made changes to their medications and 81.81% (18/22) of those changes included taking less medication. Of the patients surveyed, 95.45% (21/22) felt that the changes that have been made are beneficial to their overall health.

Conclusion: Student pharmacist-driven medication reviews may benefit overall patient care and satisfaction with their overall health.

Category: Preceptor Skills

Title: Utilization of a longitudinal academia experience for postgraduate year one (PGY-1) pharmacy resident introduction to and preparation for faculty roles

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Purpose: Exposing pharmacy residents interested in academic careers to the wide-range of faculty roles and responsibilities presents a challenge. Those completing residency programs may not be fully aware of the differing roles and requirements of being a successful faculty member. While rotational experiences have much to offer and include advantages such as ease of scheduling, a brief, time-limited experience may not provide the opportunity for residents to participate in or gain exposure to many areas and requirements of an academic career. Design and implementation of a comprehensive, longitudinal experience was undertaken.

Methods: Review of a faculty annual plan/review document, workload assignment, and promotion and tenure grid provided a broad range of topics pertinent for inclusion in a comprehensive longitudinal academia experience for a PGY-1 pharmacy resident. A 10-month schedule was developed with planned activities, experiences, and discussions to provide an introduction and basic experience in a variety of faculty roles. The planned resident roles and experiences included readings and discussion, shadowing, faculty meeting attendance with preceptor, lecture development and delivery, and small- and large-group discussion leading. In conjunction with this, an opportunity to act as a primary student preceptor along with a program preceptor was identified. Topics and experiences planned included therapeutics sequence small- and large-group discussion assistance progressing to facilitation, comprehensive outline of faculty roles and responsibilities, discussion of promotion and tenure process and requirements, discussion of each evaluation area of the promotion and tenure grid, discussion of strategies to balance practice and academic responsibilities, overview of potential teaching setting/roles, student precepting, structure and function of the college overall including standing committee roles, and student outreach/mentoring. In addition, the resident completed a residency program required ACPE accredited teaching certificate program.

Results: A PGY-1 resident added this experience to their program for the 2012-2013 residency year. The PGY-1 was paired with a faculty preceptor to plan and complete the above design. The resident participated in all discussions/experiences as designed/planned above. Participation in this experience required some scheduling flexibility from other program preceptors and the resident.

Conclusion: This experience, added as an elective to a PGY-1 residency program, was well received by both resident and preceptor. The program director and preceptor involved, along with other program preceptors, feel this experience has provided a more accurate and complete introduction to faculty roles and requirements than other strategies previously utilized, including rotational academic experiences. A longitudinally designed academia experience may be useful in assisting pharmacy residents considering a faculty role to gain experience in and have a more broad understanding of the multi-faceted responsibilities, opportunities, and requirements of faculty positions.

Category: Psychotherapy / Neurology

Title: Antipsychotic use and risk of rhabdomyolysis

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Purpose: Despite published case reports, rhabdomyolysis is not a well-understood adverse effect of antipsychotic use. The purpose of this retrospective cohort study was to describe the relationship between antipsychotic use and rhabdomyolysis.

Methods: Patients admitted to a private medical center with rhabdomyolysis, in the absence of neuroleptic malignant syndrome or serotonin syndrome, and taking an antipsychotic between January 2009 and October 2011 were included in the study. Background demographics, laboratory data, medical history and physical, concomitant medications, and hospital course data were collected.

Results: Of 673 cases admitted with rhabdomyolysis, 71 cases (10.5%) were on an antipsychotic versus only 1.3% of the general population in the US taking an antipsychotic ($P < 0.0001$). Cause of rhabdomyolysis was not documented in 38% of cases and antipsychotic use was suspected by the provider in 10% of cases. No statistically significant correlations were found between antipsychotic type and other patient specific parameters including age, gender, peak creatine phosphokinase, peak serum creatinine, recreational drug use, concomitant illnesses, smoking status, concomitant medications, or outcome. Seventeen (25%) of these patients were taking two or more antipsychotics. The largest percentage of patients was on quetiapine which is the most prescribed antipsychotic in the US.

Conclusion: Antipsychotic use is a risk factor for rhabdomyolysis and seems to be more common in those taking multiple agents. More research needs to be done to determine which antipsychotics have a higher risk and which receptor(s) are involved. Providers should be aware of the risk of rhabdomyolysis associated with antipsychotic use.

Category: Quality Assurance / Medication Safety

Title: Anti-Diabetes Medications and Acute Pancreatitis: Pharmacovigilance Analysis of Spontaneously Submitted Adverse Event Reports

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Purpose: Acute pancreatitis is multifactorial in cause; however, there has been a rising concern about the association between anti-diabetes medications (ADM) and acute pancreatitis. Previous research showed conflicting findings, and this analysis of the FDA Adverse Event Reporting System (FAERS) aims at investigating signals of acute pancreatitis across pharmacological classes of ADM and within individual class.

Methods: A retrospective pharmacovigilance analysis of the FAERS is conducted on adverse event reports in patients exposed to ADM spontaneously submitted between 1997Q3-2012Q1. The Preferred Term (PT) pancreatitis acute of the Medical Dictionary for Regulatory Activities is used to define the outcome, and exposures defined by generic names of individual ADM. Sensitivity analyses were conducted by creating a custom term for the outcome by including the following PT: autoimmune pancreatitis, ischemic pancreatitis, pancreatitis, pancreatitis acute, pancreatitis hemorrhagic, and pancreatitis necrotizing. Reports with PT for other pancreatic disorders were excluded from analyses. Disproportionality analysis by proportional reporting ratio (PRR) and corresponding 95% confidence interval (LL05-UL95) is applied to detect safety signals inter- and intra-class comparisons. Associations with LL05 of 2 or greater are considered significant safety signals. Classes included alpha glucosidase (AG) inhibitors, metformin, sulfonylureas, thiazolidinediones, meglitinides, incretin enhancers, and single-pill combination products.

Results: 1,183 acute pancreatitis PT and 4,481 custom term reports for ADM were identified in FAERS, respectively corresponding to AG inhibitors, n=5 and n=13; metformin, n=127 and n=260; sulfonylureas, n=32 and n=80; thiazolidinediones, n=55 and n=204; meglitinides, n=13 and n=36; incretin enhancers, n=912 and n=3,704; and combinations, n=39 and n=184. Acute pancreatitis PT and custom term PRR and (LL05-UL95) compared to other ADM respectively were: AG inhibitors 0.84 (0.35-2.03) and 0.58 (0.33-0.99); metformin 0.98 (0.83-1.16) and 0.52 (0.47-0.59); sulfonylureas 0.53 (0.37-0.75) and 0.35 (0.28-0.43); thiazolidinediones 0.12 (0.09-0.16) and 0.12 (0.10-0.14); meglitinides 0.54 (0.31-0.93) and 0.39 (0.28-0.54); incretin enhancers 1.94 (1.87-2.00) and 2.09 (2.06-2.12); and combinations 0.65 (0.47-0.88) and 0.81 (0.70-0.93). Compared to all ADM, estimates for incretin enhancers were: exenatide 1.46 (1.37-1.55) and 1.54 (1.49-1.59), n=535 and n=2,133; liraglutide 4.90 (4.37-5.48) and 4.00 (2.73-4.28), n=242 and n=734; saxagliptin 4.47 (3.00-6.67) and 4.60 (3.73-5.67), n=24 and n=91; and sitagliptin 2.33 (1.95-2.78) and 4.02 (3.75-4.31), n=111 and n=707. There were no reports of acute pancreatitis PT for linagliptin, yet 39 reports of custom terms with estimates of 6.41 (4.64-8.85) were identified.

Conclusion: Compared to other ADM, incretin enhancers are associated with higher than expected reporting of acute pancreatitis. Prescribers should monitor patients with diabetes for signs and symptoms of pancreatitis while treated with incretin enhancers. Given the inherent limitations of spontaneous reporting systems of adverse drug events, pharmacoepidemiological studies are required to test the generated hypothesis and to draw clinically rigorous conclusions.

Category: Quality Assurance / Medication Safety

Title: Quality control of compounding process and parenteral nutrition

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Purpose: The preparation of parenteral nutrition is made an aseptic process in a controlled environment and classified according to the number of particles present in the air. To ensure the quality and safety of this process, these areas should be monitored. Among the controls performed are: viable particle counting in the environment production of parenteral nutrition, surface analysis (supplies, equipment and handlers), validation of aseptic technique and hand washing of the handlers and sterility testing of finished product. The aim of this study was to describe the methods of control in process of parenteral nutrition compounding and present a critical analysis of the indicator of environmental monitoring.

Methods: It was conducted a descriptive study on control methods carried out in the area of quality of a Brazilian company that produces parenteral nutrition, and analysis of the indicator of environmental monitoring from January to December 2012, held every three months. The following controls were considered: number of viable particles in the air: in 19 different points within the clean area with impaction of air in agar plate using an air sampler (Air Ideal of Biomerieux) (range: ISO class 5-01 UFC / m³ Air, ISO class 7-20 UFC / m³ air, ISO class 8-100 UFC / m³ Air); surface analysis: microbial load on the surface of packaging supplies, equipment and manipulators (limit: ISO class 5-01 UFC / m and uniforms - 10 UFC / m); validation and training of handlers: simulation of the routine filling with Broth (TSB) Nutrient Agar; validation of washing hands: check the contamination level of the palms and finger tip through a plate with culture medium before and after washing with 2% Chlorexidina. All techniques were performed as recommended by the United States Pharmacopeia (USP 36), control of the finished product: sterility testing by membrane filtration as RDC 272/98 Brazilian Ministry of Health, Brazilian Pharmacopoeia and ISO 14644, integrity testing of primary packaging: pressure hydraulic and verification the absence of primary white and dark particles: visual inspection on a screen with light and dark background.

Results: It was analysed the results of the monitoring of viable particles in the air, surface and handlers during the year 2012. In the first quarter were performed 337 analysis of the production environment and 5 deviations were found in the points: room cleaning (left and right), work area and dressing room. Regarding the process of manipulation of Parenteral Nutrition 961 analysis

were performed and it was found 9 deviations: the presence of microbial load on the surface of the vial, glove - right and left hand, right and left palm, the work area, keyboard, wall and worktop. Action taken: Maintenance and repair of air conditioning equipment in the production area. In the second quarter 1255 analysis were carried out and it was found 1 deviation in the monitoring of air of the locker room. In May 3 production variances were found work area, right elbow of the manipulator and the surface of the bottle / vial. In the third quarter 1250 analysis were performed and 13 deviations were found: surface of the handler in the points: right and left palms and left elbow of the handler. In the last quarter of 2012, 1261 analysis was carried out and there was only 1 deviation: the production environment, the air in the work area.

Conclusion: There are well-established controls for monitoring the environment compounding of parenteral nutrition to ensure the quality of the final product. The analysis results of 2012 were examined and for each result outside the limits of action established, a record of non-compliance has been opened for investigation of the reasons that may have led to increased counting. We can conclude that during the year of 2012 the deviations were close or within the target. The main reasons for the deviations found were air-conditioning equipment in the production area and the handling techniques of the professionals. Data analysis, an action and effective monitoring of the deviations are effective behaviors in monitoring the air quality and cleanliness of the clean area, which are essential for safe handling of the PN.

Category: Quality Assurance / Medication Safety

Title: Assessment of the impact of computerized prescriber order entry (CPOE) system on the reported occurrence of medication errors in a community hospital

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Purpose: To assess the impact of the CPOE system on the reported occurrence of medication errors in a community hospital.

Methods: The implementation of CPOE and other electronic services is thought to reduce medication errors and increase patient safety in hospitals. In late 2011, CPOE CANOPY system was implemented hospital-wide in our community hospital. Several standard shared baselines were developed. In early 2012, the number of beds in our hospital increased from 110 to 240, and the hospital pharmacy operation became 24-hours. The purpose of this study was to assess the impact of CPOE system on the occurrence of reported medication errors. A medication error was defined as an error which occurred in the process of ordering or delivering a medication. The medication errors were categorized as omission, wrong time, unauthorized drug, improper dose, wrong dosage form, wrong drug preparation, wrong administration technique, deteriorated drug, monitoring. This retrospective study consisted of comparing the reports of different medication error types during January-October 2008 (Pre-CPOE) and January- October 2012 (Post-CPOE). The medication errors were reported per 1000 doses of medications dispensed. The percentages were calculated using Microsoft Excel. Chi-square tests were used to evaluate the association of CPOE with increase or decrease in medication errors with a P-value of less than 0.05 considered significant. This study was exempt from Institutional Review Board approval.

Results: The total number of doses of medications dispensed from the pharmacy increased from 665,172 in 2008 (Pre-CPOE) to 1,044,014 in 2012 (57 percent) (Post-CPOE). The total number of reported medication errors also increased from 161 in 2008 to 319 in 2012 (98.1 percent). These increases in medication errors could certainly be attributed to the total volume and increased hospital beds and 24-7 pharmacy operation. However, the medication errors per 1000 doses dispensed as a volume-adjusted quality measure also increased from 0.24 in 2008 to 0.31 in 2012. The top four types of medication errors reported for 2008 versus 2012 as a percentage were as follows, respectively--omission error--13.7, 20.7, wrong time error--11.2, 16.9, unauthorized drug--38.5, 31.3, and improper dose--20.5, 14.4. Medication administration factors,

followed by order processing and dispensing factors accounted for the top three reasons contributing to these reported medication errors in both 2008 and 2012. Overall, the total number of medication errors reported increased statistically significantly in 2012 versus 2008 compared with the number of doses dispensed (P less than 0.05). However, the four top medication errors shown above did not have statistical significance Pre- versus Post-CPOE implementation.

Conclusion: Overall, the reported occurrence of medication errors increased Post-CPOE implementation. This is attributable to the overall growth of the hospital. However, fewer medication errors such as unauthorized drug, and improper dose were reported since the CPOE implementation which could be due to the elimination of hand-written and illegible orders. But, the omission and wrong time errors had increased. The inflexibility of the commercially available CPOE software could also have played a role in the results of the study. In summary, CPOE system has not helped with the reduction of medication errors in our hospital, despite the expectation to the contrary.

Category: Quality Assurance / Medication Safety

Title: Pharmacy-driven medication therapy management as part of a transitional care program at an academic medical center

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Purpose: To describe the implementation of a pharmacy-driven medication reconciliation and discharge counseling service as part of a nursing-lead transitional care program to reduce hospital re-admissions at a tertiary care, academic medical center.

Methods: Individuals requiring frequent transitions between healthcare settings are recognized as being vulnerable to receiving poor quality of care and problems with fragmentation of health information. Recognizing the costs associated with high hospital readmission rates and the recent implementation of the Affordable Care Act of 2010, our institution launched a nursing-driven transitional care program in January 2012 to help reduce admissions for specific targeted disease states in the Medicare population. One of the major issues identified by visiting nurses on their patient home visits was related to patient understanding of their medications and discharge instructions in addition to discrepancies on the discharge paperwork. To improve medication reconciliation and education, beginning in July 2012, a pharmacy team was created and a collaborative process began to identify potential strategies and best practices to help to ameliorate these issues. Starting in March 2013, the pharmacy-led team began seeing patients enrolled into this program to provide comprehensive pharmacy services, including a complete medication history upon program enrollment, detailed medication counseling upon hospital discharge, and a follow-up phone call to assure medication adherence. All pharmacy interventions are documented in the hospitals healthcare computer software system using the transitional care pharmacy note created during program development.

Results: Since this program's inception in March through June 2013, a total of 135 patient visits have been made. Patients' medication reconciliation histories have been adjusted and more than 218 medications added by this team. Further, an additional 62 interventions requiring physician approval have been completed, including medication additions, deletions, and adjustments to doses and frequencies of administration to active inpatient or discharge medication orders.

Conclusion: Transitions between care settings represent vulnerable junctions within the care delivery process for medication errors to occur. By working collaboratively with nursing

colleagues, pharmacists can become increasingly involved in this process and improve the safe use of medication.

Category: Quality Assurance / Medication Safety

Title: High-dose methotrexate and the impact of select drug interactions on renal function

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Purpose: Administration of high-dose methotrexate (HD-MTX) followed by leucovorin rescue therapy is often utilized for the treatment of multiple oncologic diseases. Methotrexate is excreted approximately 80-90% in the urine, which puts the kidneys at a high risk for toxicity. HD-MTX induced renal failure is a dangerous complication of therapy, and can lead to elevated serum methotrexate levels, increased systemic toxicity, and prolonged hospitalization. The objective of this study is to determine the impact of HD-MTX regimens alone or in combination with other drugs on renal function.

Methods: This single center, retrospective chart review identified 129 doses of HD-MTX (defined as ≥ 2 grams total dose given) administered to 43 inpatients at Beth Israel Deaconess Medical Center between June 1, 2011 and June 30, 2012. Data was collected at baseline, defined in this study as any time within one week prior to receiving the dose of methotrexate, and at 24, 48, 72, and 96 hours after infusion. Collected data included patient demographics, diagnosis, chemotherapeutic regimen, dose of methotrexate received, methotrexate levels, levo/leucovorin dose and route of administration, serum creatinine, urine pH, presence of an active order for sodium bicarbonate, and fluid balance. Pertinent drug interactions were defined as co-administration of a proton pump inhibitor or a trimethoprim-containing product. Methotrexate levels and levo/leucovorin dosing were interpreted using institution-specific guidelines for the management of high-dose methotrexate regimens. Renal dysfunction was defined as an elevation in serum creatinine of ≥ 0.4 from baseline within 96 hours of methotrexate infusion, or any increase in serum creatinine of ≥ 0.4 within 96 hours of methotrexate infusion. Data was assessed using descriptive statistics.

Results: Of the 129 doses of HD-MTX included in the analysis, the median age of patients was 54 years, with sixty-four doses (49.61%) administered to male patients. The most common tumor type was central nervous system lymphoma (37.98%). 9 doses (6.98%) saw a change in serum creatinine of 0.4 or greater from baseline, and 18 (13.95%) saw any change in serum creatinine of 0.4 or greater within 96 hours of receiving methotrexate. 23 doses (17.83%) were co-administered with either a proton pump inhibitor (PPI) or a trimethoprim (TMP) containing product. Four doses were co-administered with TMP containing products, of which one (25.00%) had methotrexate levels that were above goal. Twelve doses were co-administered with pantoprazole, of which 7 (58.33%) had methotrexate levels that were above goal. Nine doses were co-administered with omeprazole, of which 4 (44.44%) had methotrexate levels that were

above goal. Only one dose of HD-MTX given with an interacting medication (pantoprazole) was associated with elevated serum MTX levels and a serum creatinine elevation of ≥ 0.4 from baseline.

Conclusion: Interactions between methotrexate and other drugs can result in elevated plasma concentrations and reduced clearance of methotrexate, thereby increasing its toxic effect on the renal parenchyma. Medications known to compete for binding sites on dihydrofolate reductase or delay elimination of methotrexate should be discontinued prior to therapy. These interactions are particularly significant when HD-MTX is utilized because prevention of toxicity depends on rapid elimination of methotrexate by the kidneys.

Category: Quality Assurance / Medication Safety

Title: Analysis of inpatient dispensing near miss events in a municipal hospital in Taiwan

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Purpose: The issue of medication safety has been valued recent years. The purpose of this study was to examine the type of dispensing near miss reported by nurses at a municipal hospital and to analyze overall medication-related errors.

Methods: Dispensing error reports from the station/ICU nurses for the Taipei City Hospital medication error system were obtained for January 2009 to December 2010. Dispensing errors were tabulated according to the types of errors and severity of error.

Results: During the study period there are 2,387,787 inpatient prescriptions and 132 dispensing errors were reported. Of the 132 cases of medication errors, 123 cases are near miss. Errors included 78 wrong drugs (59.1%), 21 wrong numbers (15.9%), 20 wrong formulations (15.2%), 7 wrong dosages (5.3%), 2 wrong patients (1.5%) and 4 other errors. Analysis of the main reasons for wrong drugs, 25 similar name (32.1%), 24 similar appearance (33.3%), 11 similar pharmacological effects (14.1%) and 16 other reasons (20.5%). According to NCC MERP Index for categorizing medication errors, there are 123 case of category B (93.2%), 8 cases of category C (6.1%), and 1 case of category E (0.8%).

Conclusion: These data is collected and published to increase awareness of medication safety, to share learning from these incidents and near misses and to encourage a more open patient safety culture.

Category: Quality Assurance / Medication Safety

Title: Effect of electronic prescribing on medication reconciliation

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Purpose: Lack of medication documentation is linked to 46% of all medication errors, up to 20% of adverse drug events, and up to 27% of all prescribing errors in hospitalized patients (demonstrating that inaccuracies in the outpatient medication list can be responsible for complications in the hospitalized patient). In this study we look to see if implementation of an electronic prescribing system increases medication reconciliation accuracy in a family practice residency clinic.

Methods: This chart review was conducted in two phases. In the first phase medication reconciliation accuracy was measured using handwritten paper forms. In the phase 2 study, medication reconciliation accuracy was assessed after implementation of an electronic prescribing system. Audits consisted of a chart review to determine the accuracy of the medication lists. Any new medications prescribed had to appear on the list and any medications discontinued had to have been removed from the medication list. The provider must have also documented that the medication list was reviewed with the patient on the day of the visit and that they provided the patient with an updated medication list before they left. A medication list was considered to be accurate if it contained all the required information, and inaccurate if it was missing any information. Of the lists that were considered inaccurate, it was also determined where they were deficient (one list could be found deficient in more than one area).

Results: Over the course of phase 1, 17 audits were completed and a total of 650 charts were reviewed. The percentage of medication lists with inaccuracies over phase 1 was 51% (49% were considered accurate). In phase 1, the most common reason for a medication list being inaccurate was that the provider did not document that the medication list was reviewed on the day of the visit (42%). Over the course of phase 2, 15 chart audits were completed and a total of 923 charts were reviewed. The percentage of medication lists with inaccuracies during phase 2 was 37% (63% were considered accurate). Once again, the most common reason for a medication list being inaccurate was an undocumented date (63%), which may indicate that provider motivation to perform the medication reconciliation is a major factor in medication list accuracy. When comparing phase 1 to phase 2, the percentage of medication lists that were accurate significantly increased from 49% to 63% ($p<0.001$).

Conclusion: While electronic prescribing did significantly increase the accuracy of medication lists, the 14% increase is far from a complete solution. A multifaceted approach (technology, provider education, and patient education) will most likely be required to further increase the accuracy of medication lists and prevent medication errors in both the inpatient and outpatient setting.

Category: Quality Assurance / Medication Safety

Title: Assessment of the opioid sparing effect of intravenous acetaminophen after cardiothoracic surgery: Medication-use evaluation

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Purpose: Pain in the post-operative setting can cause significant patient distress. When not adequately controlled, post-operative pain can lead to increased rescue opioid use, and as a result, increased opioid related side effects. Intravenous acetaminophen (IV APAP) was first approved for use at our institution in cardiothoracic surgery (CTS) patients to minimize pain and reduce the use of opioid analgesics. To ensure that IV APAP was having its intended effect of reduced opioid utilization in CTS patients, a retrospective analysis was performed.

Methods: The electronic medical records of patients who underwent CTS at our institution from February 1, 2012 until January 31, 2013 were reviewed. Patients who receive IV APAP were separated from those who did not, and the administration of narcotic analgesics in the twenty-four hour post-operative period was compared. The following medications, associated routes of administration, and doses were recorded using the electronic medication administration record: Fentanyl, morphine, hydromorphone, hydrocodone, codeine, meperidine, oxycodone, and methadone. To allow for a direct comparison between the treatment and comparator groups, all narcotic analgesics were converted to their intravenous morphine equivalent in milligrams. Patients were excluded from the study if their use of IV APAP deviated from the defined four dose maximum as described by the hospitals Pharmacy and Therapeutics Committee and if they were under the age of 18, or over 89 years. Gender and surgery type were recorded to assess similarity between the two groups. The amount of patients who required continuous infusions of opioids were noted.

Results: A total of 97 patients were evaluated, 46 in the IV APAP group and 51 in control group. There was a similar proportion of males and females in each group. Mean opioid use over twenty-four hours after surgery was 10 mg of intravenous morphine equivalent in the IV APAP group and 15.8 mg of intravenous morphine equivalent in the control group ($p = 0.085$). The most common opioid used in the post-operative setting was intravenous hydromorphone (76%, 80.4% respectively), followed by oral oxycodone (63%, 49%). Patients underwent coronary artery bypass graft (CABG) surgery most commonly (50%, 68.6%), followed by aortic valve replacement (37%, 15.7%) and other CTS (13%, 15.7%). Two patients in the control group were

administered fentanyl continuous infusions which contributed to their 76 mg and 142.5 mg IV morphine equivalent total.

Conclusion: Though the absolute difference in opioid use was similar to previous studies in CTS patients, there was not a statistically significant difference in opioid use between the two study groups at RWJUH. The common use of oral oxycodone indicates that use IV APAP deviated from the protocol set forth by the Pharmacy and Therapeutics Committee. Due to sample size limitations there is a possibility of type-2 error. The intended effect of reduced opioid use in the post-operative setting was not realized, and further evaluation must be done before IV APAP use is extended to other indications in our institution.

Category: Quality Assurance / Medication Safety

Title: Impact of emergency department dispensing on antibiotic compliance in a Veterans Affairs Medical Center

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Purpose: Optimal treatment outcomes upon emergency department (ED) discharge are dependent on patient compliance with follow-up instructions. Unfortunately medication noncompliance, especially with antibiotics, is common. The veteran population also face additional barriers to pharmacy access than their civilian counterparts. Physician dispensing in the ED may reduce these barriers as well as improve medication compliance, convenience, and treatment outcomes. However, this service remains controversial due to the lack of pharmacist review and safety and quality checkpoints. The impact of ED dispensing on current antibiotic compliance rates and the subsequent risk of medication error should be assessed in order to justify the service.

Methods: This retrospective chart review was approved by the institutional review board and research and development committee. The last 140 patients ordered at least one antibiotic upon ED discharge were included in the study. Patients were excluded if ordered non-oral antibiotics or ordered was placed and filled during the institutions outpatient pharmacy business hours. To assess for primary noncompliance at outside pharmacies, ED orders were reconciled against the outside pharmacy invoice of filled prescriptions. Baseline characteristics were derived from the institutions electronic medical record and the Cockcroft-Gault formula was used to assess prescriptions for appropriate renal dosing. The primary outcome was to assess the difference in antibiotic primary compliance rates prior to and after the implementation of an ED dispensing service. The secondary outcome was to assess medication error by evaluating orders for appropriate renal dose adjustments. A sample size of 140 was calculated to detect a difference of 10 percent and achieve a power of 95 percent. The Fishers Exact test was used to evaluate the primary outcome and a p-value of less than 0.05 was defined as statistically significant.

Results: The absolute difference in antibiotic primary compliance rates was significantly different at 13.5 percent (P less than 0.0001). Skin and soft tissue infections and related antibiotics were associated with the highest rates of noncompliance whereas diagnoses with painful or troublesome symptoms (i.e. urinary tract or dental infections) had the lowest rates of noncompliance. Dosing errors in renal impairment were apparent, occurring in 6.8 percent of patients.

Conclusion: Prescription dispensing in the ED could significantly increase the rate of antibiotic primary compliance. Dosing errors with physician dispensing, although limited, should not be

easily dismissed. Compliance with the entire antibiotic regimen and the subsequent impact on treatment outcomes are unknown, and should be further assessed in prospective, randomized studies.

Category: Quality Assurance / Medication Safety

Title: A strategy to avoid tubing and catheter misconnections: standardizing identification routes for administering medicines

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Purpose: Catheter and other tubing misconnections can lead to route medication errors, thereby resulting in serious injury or death to the patient. The Collaborating Centers for Patient Safety suggest various solutions to avoid such errors. The most effective of these would be to replace non-connectable delivery systems; however, the industry in Brazil is still far from providing such solutions for safer patient care. Another suggested strategy is the labeling of high-risk catheters. This paper describes the creation, standardization, training and monitoring of the process of identifying the main routes for medication administration.

Methods: Recommendations for identifying routes, color patterns, shapes and appropriate placement were carried out through a search of the literature. Only one guideline describing a limited amount of patterns was found, thereby demanding the development of our own standards for the hospital. Multidisciplinary meetings were held to decide which the standard routes would be. It was also decided the most suitable sites for attaching labels, the appropriate materials for clothing, and how to develop and implement specific routines and training programs for nursing staff. A pilot-project was implemented simultaneously in both a pediatric intensive care center and in an adult intensive care facility.

Results: Nine types of labeling were developed for identifying seven distinct routes, namely intravenous, central venous, epidural, external ventricular drain, arterial, enteral, and cuff. The colors and graphic pattern on each label were based on information described in the literature, as well as upon the suggestions from the multidisciplinary team. The pilot-project was evaluated for sixty days and, after adjustments, was approved for expansion to other inpatient units. Previous to having media tags available, nursing staff was trained. Three months after set up there were no reported errors relating to wrong connections; nursing staff reported the only problems concerned the physical specifications of the material.

Conclusion: The structuring of the identification process of access routes and the qualifying of professionals through training are attempts to increase the safety of the medicating procedure and to contribute to the quality of patient care. Nevertheless, the changing process and fitting routines still require constant monitoring in order to demonstrate the effectiveness of these efforts.

Category: Quality Assurance / Medication Safety

Title: Adverse drug reactions induced by antineoplastic agents in hospitalized patients

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Purpose: : Cancer is the leading cause of death in the world. It has been estimated that adverse events are between fourth and sixth leading cause of death in the United States. Antineoplastic agents are the most frequent cause of adverse drug reactions after antibiotics. Detection, prevention and treatment of adverse drug reactions (ADRs) are the prime importance in chemotherapy management. The purpose of this study was to evaluate adverse events induced by combination chemotherapy regimens involving cytotoxic antibiotics in hospitalized patients.

Methods: This descriptive study was done in a cancer institute for six months. Patients who provided informed consent were enrolled in the study. A pharmacist recorded demographic data, medical and drug history for all patients at admission. All patients were interviewed for detecting chemotherapy induced adverse reactions during and three weeks after treatment courses. Medical records and laboratory test results were also reviewed. National yellow card form and National Cancer Institution (NCI) toxicity criteria were filled out for suspected ADRs. Causality and seriousness of ADRs were assessed based on World Health Organization (WHO) definition and preventability of ADRs was determined by criteria of Schumock and Thornton questionnaire.

Results: A total number of 421 chemotherapy treatment courses were evaluated, among them 202 courses in men and 219 courses administered to women (in 48 men and 53 women). During the study period 2812 adverse reactions were recorded. The mean adverse reactions per course were 6.68. The most frequent complications were gastrointestinal system disorders (29.16%), skin and appendages disorders (28.66%) and urinary system disorders (12.52%). One hundred twenty seven ADRs were recognized to be serious. Regarding causality assessment 1891 ADRs were certain, 272 were probable, 614 possible, and 35 classified as unlikely. Among all detected ADRs only 4 of them reported to be preventable.

Conclusion: Antineoplastic agents cause severe adverse effects and it is necessary to perform prevention protocols (especially for high-risk regimens) to reduce chemotherapy associated morbidity and mortality.

Category: Quality Assurance / Medication Safety

Title: Development and Implementation of a Medication Safety Program in the Lebanon

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Purpose: Medication safety has become a primary focus of pharmacy practice in the United States and has yielded many best practices in patient care. Advancements in medication management process, Lean/Six Sigma, technology, and development of a medication safety officer position has created a framework for hospitals in the United States to provide safe care. In Lebanon, there is varying degrees of pharmacy practice standards and medication management depending on the organizations healthcare maturity, leadership, and funding. Practices such as medication closets, paper prescriptions, stockpiling, bulk medication supplies, and floor based intravenous compounding remain in parts of the Lebanon. Such practices may contribute to medication errors and related safety concerns in the medication use process.

Methods: A team was formed to identify the gaps in medication management, develop corrective actions, policy changes, and implementation strategies. To identify practice gaps, the team undertook an exhaustive review of internal practices using a proprietary medication safety gap analysis and task management software solution. In addition, the team completed a patient safety survey to gain insight into staff perceptions of culture and practices. An actionable task list was developed and validated by United States based medication safety officers. The list focused on improvements to the medication ordering process, medication review, medication storage, monitoring, and error reporting. The implementation plan was presented to leadership for consideration.

Results: The results of the gap analysis program yielded more than 100 actionable improvement strategies for safe medication use. The United States based team and Lebanon team prioritized the work list to focus on high risk processes with a high success rate of adoption during the first phase of the project. Some of the initial improvements included: (1) development of a standard order process; (2) development of a medication profile; (3) pharmacist intervention documentation; (4) high alert medication storage and labeling; and (4) establishing a medication error reporting program. Further, the results from the culture of safety survey were reviewed by hospital leadership for consideration. A culture of safety survey and medication safety education program was developed and deployed via webinar to the Lebanese based pharmacy team. The dissemination of targeted medication safety education focused on the gaps identified in the culture of safety survey.

Conclusion: The development of a comprehensive medication safety program is a large undertaking for a hospital. The combination of engaging staff through culture of safety surveys, gap analysis, and develop of action plans was critical to success of the program. Partnership between the United States based medication safety officers and Lebanon pharmacy staff was crucial to the success of the program.

Category: Quality Assurance / Medication Safety

Title: Impact of pharmacist driven HYDROmorphine dose restriction on patient safety in a large community hospital.

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Purpose: To improve utilization of and decrease the number of adverse drug reactions (ADRs) associated with the use of HYDROmorphine.

Methods: The Medical Executive and P&T committees approved and implemented a protocol for pharmacists to contact the prescriber of orders for HYDROmorphine doses greater than 1mg. The pharmacist would discuss the patient case, drug potency, morphine equivalencies, possible complications and risks and alternative medications to avoid excessive dosing of HYDROmorphine. The hospitalwide initiative was implemented on August 1, 2011. HYDROmorphine dose data was collected using the facility's charging software, Affinity, for all patients with a charge for intravenous HYDROmorphine between June 2010 and September 2012. ADR data was collected from facility reporting databases. Data was analyzed using Microsoft Excel and Access. Statistical significance was evaluated with the unpaired t-test.

Results: Over the 14-month period prior to implementation there were a total of 25 HYDROmorphine related ADRs reported; after implementation there were 6 HYDROmorphine related ADRs reported ($p=0.0009$). In the pre-intervention and post intervention group, the mean number of doses greater than 1mg was 108.14 orders per month and 30.92 orders per month respectively ($p=0.0001$).

Conclusion: The pharmacists dose restriction interventions led to a statistically significant decrease in ADRs related to the use of HYDROmorphine and a statistically significant decrease in the number of HYDROmorphine orders greater than 2mg.

Category: Quality Assurance / Medication Safety

Title: Evaluation of pharmacist managed medication reconciliation

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Purpose: Patients take numerous medications, supplements, and herbals, which increases the complexity of managing medication reconciliation and increases error in initiation. In medication reconciliation, a clinician compares the medications a patient should be using to how they are actually taking them. Initiation of patients appropriate home medications is a focus of the hospital national patient safety goals. Transition from the community setting to the hospital for acute care is a period when people are vulnerable to medication errors. This can result in a more complex and extended length of stay for the patient as well as increased costs.

Methods: This study is a prospective study reviewing the errors that were resolved during completion of pharmacist initiated medication reconciliation. Patients were included in the study starting May 9th 2013 through June 12th, 2013. Inclusion to the study consisted of adult patients admitted by physicians in the physician group Inpatient Physician Associates (IPA) at a not-for-profit 356-bed hospital in Lincoln, Nebraska. Patients admitted by four physicians were included and two pharmacists were utilized in this study to create consistency in the process. Currently, the management of medication reconciliation consists of a nurse collecting information from the patient, patients medication list, family members, and/or previous hospital, or long-term care facility. During this study, a pharmacist completed medication reconciliation when the patient was admitted or if a list was already obtained from the emergency department nurse or admit nurse, that list was utilized to recomplete the process. The main endpoint of the study was to determine the number of errors resolved during pharmacist completion of medication reconciliation. Secondary endpoints included type of errors, time to completion, and number of phone calls completed.

Results: 15 patients were included in the study during the specified time period. The patient demographics included an average age of 64.5 (36-87) years, sex 46.6% males, Medicare insurance 73.3%, and average total number of medications 13.2 (6-36). A total of 50 errors in medication reconciliation were observed and corrected with an average of 3.3 medication adjustments per patient. The most common error was wrong information including dose, route, and formulation, which occurred in 68% (34/50) of errors. The second most common error included missing medications in 18% (9/50) of errors. The remainder of errors in medication reconciliation occurred in < 5% and included compliance issues variances and extra medications. The average time to completion of medication reconciliation was 39 (24-86) minutes. Medication lists were obtained prior to pharmacist completion by emergency medicine nurses in

46.6% (7/15), express admit nurses 33.3% (5/15), and floor nurse, outside facility, and patient list occurred in 1 patient.

Conclusion: Pharmacist completion of medication reconciliation decreased errors in medication reconciliation, which normally were accepted as an appropriate medication list. Medication reconciliation continues to remain a challenge in healthcare facilities. This study demonstrates the importance of pharmacist completion of medication reconciliation. The clinical significance of these findings would need to be further evaluated in larger multicenter studies reviewing length of stay, medication errors, and cost. Outcomes from this study will be utilized to develop a broad based approach to medication reconciliation in our medical center during the next fiscal year, as well as credentialing for pharmacists.

Category: Quality Assurance / Medication Safety

Title: Prescription Analysis of pediatric inpatients at Seoul National University Hospital

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Purpose: Prescription review is the primary task of pharmacist in prescription filling process and its results can be changed by the pharmacists work experience and skills. Without prescription review, prescription errors can cause medication loss or affect patient care outcome. This study is designed to evaluate pharmacists role on pediatric medication treatment by reviewing the prescriptions and analyzing the medication errors

Methods: From January 2012 through September 2012, we reviewed prescriptions to analyze types of prescription errors and pharmacists interventions during prescription filling process in inpatient dispensary, Pediatric Intensive Care Unit (PICU), and department of pediatric oncology at Seoul National University Hospital.

Results: According to the results, which analyzed types of prescription errors, inappropriate drug dosage (50.3%) and inappropriate drug choice (13.5%) were the most common errors in inpatient dispensary. During clinical specialists prescription filling process in PICU and department of pediatric oncology, inappropriate drug dosage (59.2%, 47.4%), failure to receive drug (3.7%, 16.1%), untreated disease state (11.1%, 0%), inappropriate treatment choice(0%, 12.5%) were respectively the most common errors. Types of pharmacists interventions in inpatient dispensary are drug dosage adjustment (50.3%) and recommendation of alternative drug therapy (13.5%). However, clinical specialists interventions as a part of health care team in PICU and department of pediatric oncology were more varied. The types of interventions were drug dosage adjustment (59.3%, 49%), provision of drug information (3.7%, 10.9%), recommendation of alternative drug therapy (7.4%, 10.9%), suggestion of initiating drug therapy (7.4%, 15.6%), and suggestion of discontinuing drug therapy (11.1%, 8.3%), and etc. Pharmacy clinical specialists take ward rounds with primary care physicians and share patient treatment plans with them in PICU and department of pediatric oncology. Therefore, the pharmacist interventions in the departments show different results from the ones in inpatient dispensary where pharmacists only rely on information listed in prescription for filling patients prescription.

Conclusion: The study shows that there is a difference in prescription filling process of pharmacists in inpatient dispensary and clinical specialists as a part of health care team in PICU and department of pediatric oncology. In order to improve patient treatment outcomes, we need a

system, which can more accurately check medication error during the prescription process and during patient care teamwork. Also, pharmacists should take more responsibilities in the process of patient care by giving recommendation of initiating or discontinuing drug therapy and suggestion in drug dosage adjustment.

Category: Quality Assurance / Medication Safety

Title: Impact of pharmacy technician mediated medication reconciliation in the emergency department

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Purpose: Obtaining an accurate and complete medication history is an integral part of The Joint Commission's mandated medication reconciliation process. Staffing a medication reconciliation pharmacy technician in the emergency department may increase patient safety. Pharmacy technicians might obtain a more complete and accurate medication history; thereby preventing a greater number of medication-related adverse drug events (ADEs). The purpose of this study is to determine the impact a medication reconciliation pharmacy technician has on preventing ADEs in patients admitted through the emergency department.

Methods: The institutional review board approved this single-center, retrospective chart review. Patients were excluded from this study if they reported taking no home medications or if they were not interviewed by a certified pharmacy technician during hospitalization. Standard practice of nurse or physician obtained medication history was completed upon initial patient presentation to the emergency department. Once admitted to the hospital, a certified pharmacy technician interviewed the patient or primary caregiver, noting any discrepancies in medication histories. A discrepancy was considered to be any missing or incorrect medication information. Each discrepancy was considered a marker of potential ADEs, as any deviation could potentially result in an ADE. All discrepancies were documented in the medication history section of the patients electronic chart and made available to the attending physician for review. The primary endpoint was discrepancy rate per medication history. Secondary endpoints included mean time to discrepancy resolution, frequency of drug classes with the most discrepancies, frequency of category of discrepancy, and estimated cost avoidance of adverse drug events associated with an inaccurate medication history. The estimated cost avoidance was calculated utilizing a reconciliation tracking tool.

Results: Based on the medication histories reviewed, a certified pharmacy technician was able to identify a 38.1% discrepancy rate (95% CI 34.1%- 42.2%) per medication history. Additionally, mean time to resolution was 14.98 hrs (95% CI 13-16.9 hrs). The most frequent type of discrepancy was omitted medication followed by omitted frequency and omitted dose. The observed drug class with the most discrepancies was cardiovascular medications, followed

by pain relievers and muscle relaxants, gastrointestinal drugs, and nutritional supplements. Based on the data collected, it is predicted that there will be approximately 14,700 medication interventions per year. If only 3% of those discrepancies resulted in an adverse drug event, then the annual estimated cost avoidance is \$962,543.

Conclusion: A certified pharmacy technician was able to identify, on average, a 38.1% discrepancy rate per medication history, suggesting a positive impact on obtaining accurate and complete medication histories in the emergency department. Further prospective investigation of larger, comparative groups is necessary to evaluate the full potential of clinical impact.

Category: Quality Assurance / Medication Safety

Title: Impact of decentralized pharmacy practice model on safety reporting metrics: adverse drug events.

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Purpose: Hospitals are required to track instances of patient harm, including Adverse Drug Events (ADEs), as a condition of participation for CMS, in order to participate in Medicare and Medicaid programs. Decentralized pharmacists, can play an important roll in patient care, providing unit-specific cognitive services, such as teaching, drug information, and patient counseling. Therefore, getting more pharmacists to the units should have an impact on patient contact activities, as well as quality and medication safety outcomes. After increasing the number of decentralized pharmacists, our objective was to determine their impact on select hospital indicators of quality and medication safety.

Methods: Over the past few years, the departmental goal was to move to a more decentralized pharmacy practice model as the need and requests for pharmacy services expanded. Our hospital is the practice site for three clinical pharmacy faculty, Critical Care, Internal Medicine and Psychiatry. As a departmental initiative, additional decentralized pharmacists were added including clinical specialists in Emergency Department (ED), and Infectious Diseases (ID), and one unit-based pharmacist in the medical/surgical cardio-telemetry area. Part of the departmental initiative, involves the pharmacists documenting their daily activities using an internet-based tool. Data from their documentation were analyzed in 6-month intervals from January 2009 to December 2012. Documented activities, included: rounds attended, patient contact, and adverse drug reactions: total (ADR-T), and prevented (ADR-P). Rounds attended and patient contact were corrected per 1,000 patient days. The data was correlated to the number of unit-based pharmacists, including clinical specialists. A correlation (r) of 0.8 or greater was considered strong, and 0.5 0.79 was considered moderate. Mean values prior to expansion (Baseline, 2009-2010) were compared with after expansion (Intervention, 2011-2012) using t-test.

Results: From 2010, our department has increased the number of unit-based pharmacists from four (baseline) to seven (intervention), including the faculty. Increasing decentralized pharmacists increased documentation of rounds attended (508 vs. 810.75, $p=0.277$; $r=0.635$), patient contact, (299 vs. 1399, $p=0.002$; $r=0.973$), total ADRs (118.8 vs. 267.3, $p=0.001$; $r=0.853$) and ADRs prevented (14.5 vs. 38.25, $p=0.038$; $r=0.76$). When normalized per 1,000 patient days, there was also an increase in rounds attended (10.57 vs. 17.49, $p=0.24$; $r=0.669$), patient contact (6.23 vs. 30.25, $p=0.002$; $r=0.974$), ADR-T (2.49 vs. 5.78, $p=.00134$; $r=0.898$) and ADR-P (0.305 vs. 0.83, $p=0.039$; $r=0.758$). There were strong positive correlations with patient contact and ADR-T, even when normalized per 1,000 patient days. There was a moderate

positive correlation with Rounds Attended/1,000 patient days, ADR-P, and ADR-P/1,000 patient days. While increases were seen both in faculty (77.75 vs. 94.5, $p=0.508$; $r=0.067$) and staff (41 vs. 172.75, $p=0.004$) reporting of ADRs, but a strong correlation was only seen in staff reporting ($r=0.937$). Retrospective ADR chart reviews decreased (95.5 vs. 7.25, $p=0.00003$; $r=-0.943$) whereas spontaneously generated ADR reports increased (23.25 vs. 246.75, $p=0.003$; $r=0.937$).

Conclusion: Expanding to a more decentralized pharmacist model not only provides pharmacists the opportunity to better apply their skills, but also can improve patient safety. Incident reporting systems, are primarily voluntary, and is commonly under-utilized especially in regards to adverse drug events. All adverse drug reports (total and prevented) were spontaneous and completed in real-time. ADR-P events, provides a more direct opportunity to affect patient care, i.e. before any patient harm occurs. Expanding the number and type of pharmacists on the units increased the pharmacy departments visibility on rounds, patient contact and more spontaneous reporting of adverse drug events, especially preventable incidents.

Category: Quality Assurance / Medication Safety

Title: Implementation and evaluation of a pharmacist-led medication reconciliation initiative in the emergency department

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Purpose: Approximately 67% of patients admission medication lists and 80% of discharge medication lists are not accurate and complete at Little Company of Mary Hospital. This results in potential adverse patient events, failure in hospital quality alliance measures, and patient and healthcare provider dissatisfaction. The purpose of this study is to evaluate improvements in admission and discharge medication lists after initiation of a pharmacist led admission medication reconciliation initiative in the emergency department.

Methods: Patient admission home medication orders were reviewed retrospectively and assessed for accuracy of medication information, as well as completeness. A baseline assessment was conducted in August of 2011, and follow-ups were done in September 2012 and March 2013. Medication reconciliation was completed by a pharmacist for 90-100% of patients admitted to the hospital from the emergency department during each pharmacist shift from September 2012 to March 2013. The pharmacists shift varied from eight to twelve hours daily. The pharmacist would review the patient chart, identify disease states in the patients past medical history, and recognize any potential errors or non-evidence based treatments. The pharmacist would then interview the patient and obtain an accurate medication history. In order to ensure accuracy and compliance, the pharmacist would frequently contact outpatient pharmacies, family members and physician offices. The medication history obtained by the pharmacist was entered into the electronic medical record and was also printed out and placed in the patients paper chart. After the history was completed, the pharmacist would write a progress note outlining the process completed to obtain the medication history, highlighting any recent changes in medication therapy, and recommending changes to medication therapy, if necessary.

Results: After implementation of the pharmacist initiative for medication reconciliation in the emergency department, the percentage of admission medication lists that were accurate and complete increased from 32.3% to 94.2%. The average number of errors per patient on admission decreased from 2.94 errors per patient to 0.07 errors per patient between August 2011 and March 2013. Discharge medication lists were reviewed only for August 2011 and September 2012. When examining the discharge medication lists, 25% were accurate and complete in September 2012, compared to 16.7% in August 2011. Improvement was also evident in the average number of errors per patient on discharge, decreasing from 4.2 to 2.92.

Conclusion: Admission medication lists were substantially improved when a patients medication history was completed by a pharmacist, as compared to a nurse. As a result of improvement in the admission medication histories, an increased accuracy at discharge was also observed. Future plans involve including a pharmacist on discharge to further improve the accuracy of discharge medication reconciliation.

Category: Quality Assurance / Medication Safety

Title: Implementation and improvement in pharmacy and nursing electronic communication: a medication safety, quality improvement and quality assessment of technology process

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Purpose: The need to increase medication safety and quality, as well as minimize pharmacy errors by improving interdepartmental communication, was identified as part of the Failure Mode Effect Analysis process at the institution. This project was designed to implement and enhance electronic communication technology between nursing and pharmacy via education, monitoring and re-education. A quality assessment of such technology, challenges to a process change, and the analysis of effectiveness and outcomes were included in the program design.

Methods: A manager-in-training (MIT) pharmacist developed a very brief presentation identifying situations where electronic communication is appropriate versus other forms of communication including phone and scanning paper requests. Simple instructions, screenshots and minimal slides were prepared including pros and cons and contact details. The MIT conducted short 5 minute individual and group in-services with hands-on application in a real time system. Additionally, 15 minute presentations at nurse orientations, departmental, nursing director, and management meetings were conducted to reinforce the project goals. Approximately 400 RNs were in-serviced at a 268-bed licensed institution in Louisiana. RNs were trained to communicate electronically via the institutions Electronic Medication Administration Record (eMAR) system. For specific patients, RNs can request medications, send generic messages to pharmacy, request missing doses, removal of duplicate orders, and change administration times. Nurses were educated on the appropriate method of communication to use depending on the situation. Electronic requests crossed over to Pharmacy Order Medical System (POMS) within 30 seconds in an electronic pharmacist work queue (EPWQ). Pharmacists monitor this queue closely, quickly and efficiently process the requests. Progress and statistics were monitored via a Crystal report that the MIT created. Staff pharmacists and nursing were consulted for feedback and process improvement.

Results: Approximately 257 RNs were in-serviced and 11 FTE pharmacists were engaged in monitoring and processing the EPWQ. The project leader ensured training consistency was enforced. Challenges were overcome by asking staff to demonstrate what they know and reinforcement of the unknown. The advantages of electronic communication were also emphasized at the start and end of the in-service. Objectives achieved included; decreased calls to pharmacy permitting an increased focus on accuracy, the timeliness of medications delivery was improved by decreased processing time and reduced delays in regular scanned order queue and patient safety was also increased by double checks during electronic medication request by nursing and electronic verification by pharmacists. Nursing was satisfied with faster turnaround times and the ability to request medications from the eMAR application. Measurable goals were accomplished by analyzing the EPWQ and adjusted patient day reports and results. The EPWQ

increased while the scanned order queue decreased significantly. Pharmacy error rates were decreased but statistical significance is difficult to achieve with an already low error rate. Positive feedback was received overall but the need for improved communication from pharmacy to nursing was also identified and to be investigated in another study.

Conclusion: Interdepartmental electronic communication, used in appropriate situations, increases patient safety, decreases the risk of errors, improves turnaround time and can be conveniently done anywhere there is a computer station. It also increases the pharmacy departments efficiency, productivity, accuracy and results in fewer phone calls to pharmacy which can result in decreased errors. Electronic communication with similar types of software applications is recommended for implementation at other institutions, reinforced by the outcomes and results of this project.

Category: Quality Assurance / Medication Safety

Title: Implementation of inventive query to improve compliance with the Joint Commission's "Do Not Use" abbreviations list and ensure patient safety within a mail order pharmacy

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Purpose: The Department of Veterans Affairs Consolidated Mail Outpatient Pharmacy (CMOP) has a list of forty-five disallowed abbreviations. Per procedure, sigs containing these abbreviations should be cancelled back to the medical centers. Review showed poor compliance to this procedure. Further investigation found that if this rule had been fully followed there would have been a forty fold increase in cancellations for prohibited abbreviations. CMOP then decided to focus on implementing the mandatory Joint Commission (JC) Do Not Use (DNU) list of six abbreviations. The purpose of this project was to increase adherence to the mandatory JC list, ultimately ensuring patient safety.

Methods: To achieve the goal of this project, a Southwest CMOP data management pharmacist designed a Structured Query Language (SQL) to sort out all of the prescriptions with sigs containing the six abbreviations on the JCs DNU list: U (unit); IU (international unit); Q.D., QD, q.d., qd (daily); Q.O.D., QOD, q.o.d., qod (every other day); trailing zeros (X.0 mg); the lack of leading zeros (.X mg); and MS (morphine or magnesium sulfate). A production pharmacist supervisor now performs this query daily. The Southwest CMOP also shared the query with the seven other VA CMOPs. Each CMOP now performs the query each day and cancels prescriptions with matching sigs back to the medical centers, per procedure.

Results: Of 9,937,279 prescriptions examined by the initial review, 2,496 (0.025 percent) contained at least one JC DNU issue in the sig. Prior to the implementation of the daily query, 1,967 of these prescriptions were filled, with only 529 (21.2 percent) being cancelled for any reason. Since implementation, the overall percentage of matching sigs caught by the CMOP system has increased from 25 percent to 82 percent and continues to climb. The number of prescriptions sent to CMOP each month with matching sigs has decreased by 40 percent since implementation of the program.

Conclusion: Implementation of the query greatly improved compliance to the JCs DNU list. These results advocate for the modification of the CMOPs disallowed abbreviations to include only those on the JCs DNU list. Focusing on this narrowed list will minimize overwhelming the CMOP pharmacists and medical centers with cancellations and give CMOPs the opportunity to establish procedures that will produce complete compliance to the JC DNU list. Once this is achieved, CMOPs can then implement non-mandatory abbreviations that threaten patient safety.

Such queries could benefit all mail order pharmacies in achieving compliance with JC DNU standards.

Category: Quality Assurance / Medication Safety

Title: Pharmacists response to drug-drug interaction alerts: impact on alert fatigue as a result of reducing non-clinically significant interaction warnings

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Purpose: Alert fatigue is experienced by clinical practitioners during the order entry process when an abundance of alerts are triggered but not actionable. Alert fatigue has led to a concern of clinically significant alerts being ignored, thereby increasing adverse events. The purpose of this study is to reduce the number of non-actionable drug-drug interaction alerts viewed during the order entry process by re-categorization of severity levels, thereby decreasing alert fatigue and increasing safety.

Methods: A retrospective review of drug-drug interaction alerts viewed during the pharmacists order entry process before re-categorization, November 3rd 2012 through December 3rd 2012, and after re-categorization, January 4th 2013 through February 3rd 2013, was conducted. Re-categorization of non-clinically significant drug-drug interactions, assessed by an expert panel, was performed in December 2012. Numerical data was analyzed to determine if there was a statistically significant difference in responses between study groups. In addition, the number of reported errors related to drug-drug interaction alerts were reviewed to ensure there was not a significant increase secondary to re-categorization.

Results: Drug-drug interaction alerts viewed during the post re-categorization compared pre re-categorization, had a statistically significant difference in pharmacists documentation of override responses ($p < 0.001$). No significant difference was detected in the number of reported errors related to clinically significant drug-drug interaction alerts.

Conclusion: Reducing the number of non-actionable drug-drug interaction alerts by re-categorization of severity levels had a significant impact of pharmacists override documentation responses. This study provides evidence supporting re-categorization of non-actionable alerts thus decreasing alert fatigue and increasing safety.

Category: Quality Assurance / Medication Safety

Title: A successful implementation of an education program for intravenous (IV) push drug delivery for palliative care (PC) in a community hospital.

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Purpose: A robust team led by Palliative Care fellowship-trained physicians, an experienced nurse practitioner, and a licensed social worker has been providing PC to patients throughout the hospital for over two years. While PC patients are in the hospital, issues related to level of sedation, inability to swallow, or nausea and vomiting, strongly support the use of IV push medications as the most suitable mode for drug administration. The nursing staff needed education and establish competency to IV push medications specifically used in PC: furosemide, glycopyrrolate, haloperidol lactate, ketorolac, LORazepam, morphine and HYDROMORPHONE.

Methods: The Pharmacy department created a detailed IV push medication administration chart that standardized the process as well as pre- and post-dose monitoring of the patient. This chart has ready access to information on the maximum rate of administration, dilution and monitoring requirements. This is in compliance with the Institute for Safe Medication Practices recommendation to reduce harm to patients related to rapid injection of intravenous medications. A multidisciplinary team that included members from the departments of Pharmacy, Nursing and Medicine, designed and presented a 90-minute program to all RNs. The PC team gave an overview of what PC and hospice care offer this patient population. Pharmacy prepared and presented a comprehensive review of all drugs used in the therapy. This didactic presentation was followed by a hands-on session to discuss and practice all details related to dilution, administration, and safety (e.g., importance of syringe labeling). At the end of the educational session, attendees were given a multiple-choice test. The minimum of 80% to pass was met by all participants. This program was repeated four times on each nursing unit to accommodate both the day and night shifts. Attendance by Registered Nurses was mandatory.

Results: A brief survey via e-mail asking about the effects of attending the session was conducted. The responders unanimously reported that the program improved their confidence and comfort and empowered them to treat patients effectively and efficiently. The director of the cancer services reported a vast improvement in pain management since implementation of this modality. Calls to the PC team to administer IV push drugs has been reduced as the IV push drug delivery program is expanding with only three nursing units remaining. A policy and procedure was drafted and the existing PC physician order form was revised to include parameters, guidelines, and limitations with all IV push medication orders. The policy mandated that only

specific prescribers could write those orders and only educated and competent registered nurses could administer. The use of the IV push method resulted in substantial material cost savings by eliminating cost of tubing and minibags. Also, time savings for pharmacy personnel were noted. As a result of PC education program, we established a formal self-learning IV push administration module hospital-wide that provides information for all aspects of IV push administration.

Conclusion: This formal education program on IV push drug delivery in PC has helped to prepare nurses to become certified in palliative and hospice nursing. The program helped the staff to understand PC and differentiate it from hospice care. The comprehensive review of the drugs introduced strengthened the knowledge for their effective and safe use. The IV push program has also been cost-effective for the institution.

Category: Quality Assurance / Medication Safety

Title: Assessing and improving patient knowledge of proper medication disposal

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Purpose: Prescription medications may accumulate in the home medicine cabinet for many reasons, including undesirable side effects, dosage changes, nonadherence, discontinuation of the drug, or expiration. Without necessary knowledge of proper medication disposal, patients in the community are at risk of unintentional overdoses of family members or pets, theft by drug-seekers, environmental contamination, and many other harms. Furthermore, pharmaceuticals discarded directly into the garbage or flushed down the toilet may pollute the soil and groundwater. The purpose of this study was to evaluate current knowledge of proper medication disposal and disposal techniques and to educate the community on proper medication disposal.

Methods: Surveys were administered to customers at five local pharmacies in the greater Findlay, Ohio area. Study methods included the following: 1) a pre-survey was administered to assess current views and knowledge of the proper medication disposal; 2) customers were asked to read an informational pamphlet about proper medication disposal; and 3) a post-survey was administered to assess change in views and knowledge. The educational pamphlet consisted of information regarding proper, as well as improper, medication disposal techniques. Customers were excluded if they were under the age of 18, unable to read without assistance, or used the pharmacy drive-thru window.

Results: A total of 25 customers were surveyed at each of the five pharmacies. The majority of patients were greater than 60 years of age. Pre-survey results indicated that 65 percent of patients strongly agreed or agreed that improper medication disposal is an environmental issue and 70 percent of patients strongly agreed or agreed that improper medication disposal is a safety issue. After reading the educational pamphlet, an increase in the number of customers that strongly agreed or agreed that improper medication disposal was an environmental issue and a safety issue was noted, 86 and 85 percent, respectively. Additionally, the pre-survey indicated that 40 percent of customers surveyed disposed of unwanted medications in the trash and 19 percent flushed unwanted medications down the toilet or sink. After reading the educational pamphlet, six percent of customers indicated they would dispose of unwanted medications in the trash, one percent would flush them down the toilet or sink, 60 percent would use medication collection, and 41 percent would put them in the trash mixed with an undesirable substance. Additional information obtained from the post-survey discovered that 75 percent of patients believe

pharmacists should be responsible for providing patients with information about proper medication disposal.

Conclusion: Survey results indicated many pharmacy customers in Northwest Ohio are disposing of medications improperly. Educating the community about proper medication disposal increased the number of customers who believe improper medication disposal is a safety and environmental issue. After reading the educational pamphlet, the majority of customers indicated they would avoid improper medication disposal techniques and use proper medication disposal techniques. Finally, customers indicated pharmacists to be the preferred health care professional to convey information regarding proper medication techniques to the public.

Category: Quality Assurance / Medication Safety

Title: Variability in compounding of oral liquids for pediatric patients: A patient safety concern

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Purpose: The purpose of this study was to determine the degree in variation of oral liquid pediatric compounding practices in Michigan pharmacies.

Methods: All types of inpatient and outpatient pharmacies across the state of Michigan, excluding nuclear pharmacies and long-term care facilities were considered for participation. An online questionnaire was developed using Qualtrics toolkit to survey current compounding practices of 146 oral liquid pediatric medications. The survey link was dispersed by email, or by fax to hospitals, chain and independent pharmacies. In addition, all pharmacists were mailed a postcard and the Michigan Pharmacist Association publicized the project through its journal and annual meeting.

Results: The main outcome measures included pharmacies demographics, number of pharmacies that compound, number of medications compounded weekly, awareness of compounding errors, results of compounding errors, number of medications compounded, and number of concentrations compounded per medication. The majority of respondents represented outpatient pharmacies, but included inpatient and other types of pharmacies. The majority of all pharmacies compound less than five oral liquid medications per week. Awareness of errors was low overall, with no errors resulting in permanent harm or death. The number of concentrations compounded per medication ranged from one to nine, with the majority of pharmacies compounding more than three concentrations per medication. Variability was evident between and within pharmacy settings.

Conclusion: There is a considerable degree of variation in current oral pediatric liquid compounding practices in Michigan pharmacies, posing a significant risk to patient safety.

Category: Quality Assurance / Medication Safety

Title: Pharmacist-led medication reconciliation training program for medical assistants in primary care

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Purpose: The medication reconciliation process is crucial to help ensure medication safety. In primary care, the medical assistant (MA) plays a key role in ensuring the accuracy of medication lists through interviewing patients at every visit and documenting changes in the electronic medical record (EMR). Standards for performing medication reconciliation and training programs are not well defined in the outpatient setting. A training program for medical assistants to perform medication reconciliation was developed by a workgroup of pharmacists. Overall the program trained medical assistants on a standardized medication reconciliation process, presented an overview of common pharmacy topics, demonstrated verbal and written communication skills, and concluded with additional EMR training. By medical assistants completing the training program it was anticipated that medical assistants would improve their skills and knowledge to effectively perform medication reconciliation and, ultimately, to improve the accuracy of medication lists in EMR.

Methods: The pharmacist-led medication reconciliation training program for medical assistants in primary care practice was first implemented with a pilot group of medical assistants. Medical assistants participated in an 8 hour training program over 4 training sessions and completed a pre- and post- survey upon initiation of training program and 1 month following completion of training program. Respective physicians of each MA were also surveyed on their perceptions of medication reconciliation before and after the MA medication reconciliation training program. The focus areas for medical assistants included: medication list accuracy; skills and training; confidence in ability; and ability to recognize discrepancies. For physicians the focus areas included: accuracy of medication lists; reliance on MA to perform medication reconciliation; confidence in MA to perform medication reconciliation; and confidence in up to date medication list at every visit. Surveys allowed responses on a 5-point Likert scale [ranging from 1 (Strongly Disagree) to 5 (Strongly Agree)] and were compared to assess the effect of the training program on physician and MA perceptions of medication list accuracy and changes in the predefined focus areas. Survey results were analyzed using paired t-tests to evaluate the change in survey responses pre- and post-training for each focus area.

Results: Surveys of medical assistants and physicians found improved perceptions of medication reconciliation in most of the focus areas studied. While prior to the training program 56% of medical assistants (n=9) agreed or strongly agreed that medication lists were accurate prior to the training program, 89% of medical assistants agreed or strongly agreed that medication lists were

accurate after the training program. Physician survey responses (n=7) revealed improvement in overall medication list accuracy with 57% agreed or strongly agreed that medication lists were accurate before training versus 86% agreed or strongly agreed that medication lists were accurate following the training program. The focus areas which showed the greatest improvement in mean of pre- and post- response for medical assistants was in skills and training (1.00 point on Likert scale) versus for physicians was confidence in MA to perform medication reconciliation (0.86 point on Likert scale).

Conclusion: Implementation of a pharmacist-developed and pharmacist-led training program for medical assistants improved perceived medication list accuracy in our EMR. Training of other health care professionals by pharmacists in skills relating to medications is important to ensuring patient safety in a variety of settings. Continued training in a larger population will likely show similar improvements in the accuracy of the medication lists in electronic medical records.

Category: Quality Assurance / Medication Safety

Title: Pillbar: an innovative visual tool to raise awareness of medication-related, patient-specific fall risk

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Purpose: The prevention of falls in the healthcare environment is important to avoid sentinel events. Medication effects can contribute to falls. Ideal risk reduction strategies have not been identified for the prevention of medication-related falls in the healthcare environment, including the psychiatric healthcare setting. Medication therapy modification should be considered in order to reduce fall risk. A new approach to enhance real-time awareness of medication-related, patient-specific fall risk was developed at a private, non-profit, psychiatric facility.

Methods: An interdisciplinary team from Laureate Psychiatric Clinic and Hospital (LPCH) and Saint Francis Health System (SFHS) in Tulsa, OK, developed the Pillbar, a visual medication-related falls tool for the electronic medical record. Physician, nurse, and quality team members from LPCH devised the concept to help practitioners identify medication-related fall risk. SFHS Pharmacy and Information Services team members developed and implemented the concept. Pharmacy created a database to classify drugs by mechanism for increased fall risk. Medications were identified through evaluation of drug information resources and medical literature. The database identified medications associated with orthostasis, anticholinergic effects, gait disturbances, central nervous system depression, and other effects associated with fall events. Information Services utilized the database to create the Pillbar, which is displayed at the top of the medication administration record (MAR). The Pillbar uses green, yellow, and red capsules to identify medications in a real-time display on the patient's MAR with the colors associated to each fall risk category. The Pillbar was implemented throughout the entire SFHS. Pharmacy issued a seven-part education series utilizing a mascot, Steady Freddie, to train all staff about medication-related fall risk, with a focus on fall risk categories. Inservices were provided to medical and nursing staff.

Results: The Pillbar was launched in August 2012. In addition to increasing awareness at the points of prescribing, administration, and monitoring, the Pillbar has been used when evaluating other potential medication-related events, such as retrospective Rapid Intervention Team events evaluation. The education series has been posted on the health system's intranet, and the education series link is integrated into the Pillbar, enabling the user to directly access it from the electronic medical record.

Conclusion: The development of the Pillbar has been an innovative approach to raising awareness of medication-related fall risk on a patient-specific basis. Prescribers, nurses, and pharmacists have utilized the Pillbar when making patient care decisions. An education series has explained various mechanisms of medication-related falls and interventions that may help to prevent falls based on risk type.

Category: Quality Assurance / Medication Safety

Title: Effect of interprofessional collaboration on stroke core measures

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Purpose: Interprofessional teams and collaboration enhance patient care and outcomes. However, evidence related to the effectiveness of interprofessional teams or their composition is anecdotal and no studies have documented the impact of an interprofessional team on adherence to stroke core measures. The purpose of this study was to examine variations in adherence rates to stroke core measures with the addition of each member of the interprofessional team. Those members include an advanced practice nurse, physician and pharmacist.

Methods: This study was a retrospective database review of all stroke patients from a single facility between August 2008 and June 2012. Prior to August 2009, the facility had no designated person or team assigned to monitor stroke core measures. In August 2009, one advance practice nurse (APN) began to oversee stroke care for the facility. The team later added a physician and then finally a pharmacist. Adherence rates for the eight stroke core measures for each of the four timeframes (Baseline; APN only; APN and physician; and APN, physician, and pharmacist) were compared. The overall adherence rate was compared between each timeframe, as well as the adherence rates for each of the eight individual core measures.

Results: A total of 695 patients were included in this retrospective review. The baseline group (n = 100) showed an overall adherence rate to the stroke core measures of 85%. The APN only group (n = 274) showed an overall adherence rate of 83%. APN plus physician group (n = 114) showed an overall adherence rate of 93%. Finally the APN, physician, and pharmacist group (n = 207) showed an overall adherence rate of 97%. The differences between the groups were found to be statistically significant ($p < 0.001$). The most improvement in scores was noted with the addition of the final member, the pharmacist. The adherence rates for all of the eight individual core measures increased, but the increases were statistically significant in only five of the core measures.

Conclusion: An interprofessional team consisting of an advanced practice nurse, a physician and a pharmacist was the most effective at improving adherence rates to stroke core measures.

Category: Quality Assurance / Medication Safety

Title: Standardization of the continuous opioid independent double-check (IDC)

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Purpose: Opioids are one of the leading drug classes involved in harmful errors. Analysis of institution medication event data identified an opportunity for improvement regarding PCA pump programming errors. Random audits of the continuous opioid double-check process revealed that 2/3 of the checks observed were conducted co-dependently (two nurses went into the room and programmed the pump together) and that there was no standard work for how these checks were performed. Standardization of the independent double-check process was identified as a needed improvement to reduce PCA pump programming errors that reach the patient.

Methods: An independent double-check (IDC) policy was created. As part of this policy, an 11-step process for conducting a two nurse IDC of continuous opioids was developed in collaboration with the Clinical Nurse Practice Council. The Primary Nurse performs steps 1-6 and the IDC Nurse conducts steps 7-10. Step 11 involves both nurses signing the medication administration record (MAR) to document the double-check. Key elements emphasized included bringing the MAR into the patients room and programming the pump settings (drug, concentration, PCA dose, lockout interval, and continuous dose) against the MAR. The IDC Nurse then repeats these steps separately and alone and starts the infusion as programmed by the Primary Nurse, provided no discrepancies are identified. These checks occur at initiation of a continuous opioid, syringe change, reprogramming (i.e. concentration change, dose change, etc.) and at 0600, 1400, and 2200 when the 8 hour totals are collected. An 8-minute video was developed to educate staff regarding the importance of IDCs and to demonstrate the 11-step continuous opioid IDC process. The video was shown at staff meetings and made available on the intranet nursing education site. Competency documentation for nurse completion of the video and a post-test (80% passing) was tracked.

Results: 514 out of 551 (93%) patient care nurses completed the post-test questions with an 80% passing score. Nursing feedback was assessed by an online survey which was completed by 126 respondents. Respondents indicated that they always (64%), often (17%), sometimes (3%) follow the 11 steps for conducting the continuous opioid IDC; the remaining respondents did not administer continuous opioids in their practice (16%). All respondents agreed that opioid safety was a hospital priority and 95% concurred that IDCs were effective error detection strategies. 85% of respondents understood how to conduct a proper continuous opioid IDC after watching the video, while 10% had not seen the video. A total of 73% of respondents indicated that they were now more likely to report a continuous opioid error, which correlated with an increase in opioid administration error reports seen since education rollout.

Conclusion: Opioid safety awareness was improved through the standardization of the nursing IDC process. A video competency was useful to educate staff regarding the standard work steps for completing a continuous opioid IDC. However, despite awareness of the proper IDC process, staff indicated that they do not comply with this practice 100% of the time, with 17% and 3% of respondents conducting the IDC often and sometimes, respectively. Emphasis on this medication error detection strategy also heightened staff sensitivity to this issue, resulting in an increase in continuous opioid administration event reports.

Category: Quality Assurance / Medication Safety

Title: Improving the safety of medication infusion pumps through the implementation of a multidisciplinary pump safety committee

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Purpose: The avoidance of medication infusion errors is an important part of the organizations medication error reduction plan. Upon assessment of the medication infusion pumps, issues identified include sun-setting technology, suboptimal oversight, lack of standardization of pumps, poor implementation planning, and no performance improvement plans. The development of a multidisciplinary Pump Safety Committee (PSC) in an academic medical center is described, with an emphasis on improving patient safety through a formal continuous quality improvement (CQI) process.

Methods: The PSC committee is comprised of pharmacists, nurses, physicians, biomedical engineering, IT, and hospital leadership (COO, CNO, CMO, CPO) and chaired by the Medication Safety Officer. The committee meets on a monthly basis and reports to the Medication Safety Committee and Pharmacy and Therapeutics Committee. The PSC was chartered to guide selection, implementation, education, management, and monitoring of all medication infusion devices. This includes approval of all pump libraries and any additions, deletions, or changes to the libraries. The PSC also developed a CQI process which seeks to improve the safety of medications infused by the pumps through ongoing review of the smart pump reports, medical center incident reports, and library change requests. The committee reviews utilization of the pump libraries and makes recommendations for revisions to improve compliance. The goal for library compliance was determined to be greater than 95%.

Results: The first task of the PSC was to optimize the drug library of the recently implemented Baxter Sigma Spectrum pumps which were utilized for general infusions in adults and pediatric patients > 14 years old. Prior to the PSCs involvement, the library compliance was 90.7%. This increased to 95.5% the following month and has steadily increased every month to be consistently above 99% (99.1-99.7%) for the last year. The second task of the PSC was to convert the syringe pumps utilized for the younger pediatric and neonatal populations to a smart syringe pump. Following successful implementation, the initial library compliance rate was 96.9% and has consistently been above 95% (95.2-98.9%). The next task was to convert the epidural pumps. Although the pumps selected were not wireless, the PSC still performs CQI on a randomly selected group of pumps each month. The library compliance rate has been 100% for these pumps.

Conclusion: The Pump Safety Committee has successfully implemented several infusion pumps and continues to evaluate advancements in smart pump technology for future conversions. In addition, the PSC significantly improved the library compliance rate for all smart pumps through ongoing surveillance of the utilization data. The development of a multidisciplinary pump safety committee is essential to improving compliance with the smart pump libraries and improving patient safety.

Category: Quality Assurance / Medication Safety

Title: Pharmacist involvement to guide appropriate prescribing and utilization of transdermal fentanyl patches

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Purpose: Currently a Black Box Warning (BBW) exists stating the fentanyl transdermal patch is indicated only for the management of persistent, moderate-severe chronic pain in opioid tolerant patients uncontrolled by other agents. Despite the warning, fentanyl patches are still frequently inappropriately prescribed for mild, acute pain in opioid naive patients. A multistep approval process involving pharmacists was developed to guide appropriate prescribing and monitor appropriate utilization of the transdermal fentanyl patches.

Methods: Several forcing functions were incorporated into our computerized physician order entry (CPOE) system. Upon selection of fentanyl patch from the order browse, a pop up alert notifies the prescriber of the BBW. Once alert is acknowledged, the prescriber is presented with the order entry form, including questions that must be answered before one may proceed. Prescriber is asked if patient had been on any prior opioid therapy and then must select the dose from a drop down menu. If prescriber states patient has not been on any prior opioid therapy or dose is not equivalent to what is recommended, they may not continue. Then the prescriber is asked if patient has any of the listed contraindications, if they answer yes they may not continue. Despite these initial forcing functions in the CPOE system, an internal audit found that prescribers were continuing to prescribe inappropriately. Utilizing the patients medical record, the verifying pharmacist must now separately validate the existence of prior opioid therapy at appropriate doses and the absence of any contraindications. This validation is documented on a preprinted checklist form, which is collected and separately audited by another pharmacist. Audit results are then presented monthly to the Medication Safety Committee.

Results: A retrospective audit indicated that with the CPOE forcing functions alone, approximately 10% of fentanyl patches were still prescribed inappropriately. This prompted the development of the additional safety net of the pharmacists completing the fentanyl patch utilization criteria checklist form. Initially, the secondary checklist was not completed at all or was incomplete approximately 10% of the time. Re-education has been successful in increasing the compliance rate to 100%. Since the development of the checklist, approximately 1-3 inappropriate fentanyl patch orders are successfully intercepted by the verifying pharmacist each month.

Conclusion: Forcing functions within the CPOE system alone are not sufficient to prevent inappropriate prescribing of fentanyl patches. Involvement of pharmacists and development of a criteria based checklist has improved the safety of fentanyl patches prescribing and utilization.

Category: Quality Assurance / Medication Safety

Title: Development of a drug shortage tracking tool managed by a pharmacy workgroup to address drug shortages

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Purpose: The number of drug shortages increases every year and can adversely affect patient care, delay treatment, and cause medication errors. As these drugs are essential to patient care, prescribers are often left scrambling for alternatives that may be less effective and may have additional adverse effects. Institutions have struggled with how best to manage these shortages effectively and minimize the impact to patient care. The development of a Drug Shortage Tracking Tool managed by a pharmacy workgroup seeks to be proactively manage these drug shortages.

Methods: The Drug Shortage Tracking Tool was created using data obtained from the ASHP Drug Shortages website, the FDA Drug Shortages website, and the wholesalers shortage list. Based on current inventory and average monthly usage, the drug shortages are categorized using Red-Yellow-Green definitions. Red indicates immediate action is needed and a mini MUE (who uses it, who needs to know if we make changes, how much do we use, what alternatives are there) is done. Yellow indicates watch and wait with active tracking. Green indicates no immediate action needed but continue to monitor. The pharmacy workgroup is comprised of an operations representative, a clinical representative, and a medication safety representative and meets on a weekly basis. The operations representative accurately tracks the inventory and updates the Drug Shortage Tracking Tool. The clinical representative identifies stakeholders affected by the shortages and identifies therapeutic alternatives. The medication safety representative coordinates communication to stakeholders, assesses risk of action plans and therapeutic alternatives, and actively monitors for any incident reports associated with drug shortages.

Results: The pharmacy workgroup develops action plans for Red drug shortages. Standard actions include centralization of supply within the main pharmacy, rationing of the medication, restriction of the medication to select patient populations, and identification of therapeutic alternatives or alternate sources to obtain the product. Notification to providers occurs via a weekly hit list posted within the pharmacy, clinical updates/P&T newsflashes sent to nursing and prescribers. In addition alerts within the computerized physician order entry (CPOE) system, automated dispensing cabinets (ADCs), and infusion devices are considered. To hardwire the transition to therapeutic alternatives, medications unavailable due to drug shortages are removed

from the CPOE order browse and prescribers are re-directed to therapeutic alternatives with equivalence tables provided or available only for pharmacist order entry. Since the implementation of the Drug Shortage Tracking Tool and the pharmacy workgroup, there have been no unexpected drug shortages. All shortages have been managed proactively and there have been no complaints from prescribers about the lack of notification.

Conclusion: The Drug Shortage Tracking Tool allows for proactive monitoring of drug shortages and the pharmacy workgroup has provides a systematic method of managing the shortages and notifying prescribers.

Category: Quality Assurance / Medication Safety

Title: Impact of the sterile compounding strategy on a massachusetts hospital pharmacy

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Purpose: After nationwide recalls were initiated due to the compounding tragedy, a hospital pharmacy which was outsourcing approximately 95% of its compounding needs, was left wondering how to supply a 265-bed community hospital with much needed sterile preparations. With an increased scrutiny from the Massachusetts board of pharmacy, the Department of Public Health (DPH), and the Food and Drug Administration (FDA) on sterile compounding, the pharmacy clean room, staff, policies and procedures needed to be optimized to assure compliance to US Pharmacopeia (USP) chapter 797.

Methods: The Clinical Pharmacy Specialist (CPS) performed a gap analysis using the 2012 USP <797> Compliance study, a web-based tool used to identify areas of non-compliance. The survey determined that the hospital pharmacy was compliant to 42% of USP 797 requirements and identified facility design, personnel training and competency assessment, and quality assurance as the main areas of non-compliance. The hospital leadership team, including the associate director of Environmental Services (EVS), the manager of Facilities, and the Laboratory manager, were informed of the survey results and an action plan was developed to address each area of deficiency in a timely fashion. The CPS was tasked with developing policies and procedures outlining all the requirements and processes associated with sterile compounding, a training program including a didactic review of applicable requirements and competency evaluations, and a quality assurance program to identify and resolve process excursions. The facilities manager was responsible for addressing facility changes needed to comply with USP requirements while the EVS associate director was charged with ensuring the clean room was cleaned as required. The laboratory manager would ensure that competency evaluations materials were appropriately incubated and resulted.

Results: Seven policies/procedures were created to define facility standards, the cleaning and disinfecting process, personnel training and evaluation, hazardous medications, and a quality assurance program. A 5-hour training program was developed based on the American Society of Health-System Pharmacists (ASHP) sterile compounding training video. All compounding personnel were required to attend the first four hours of the program to review the standards and complete an assessment with a score of 90% or above. Pharmacy technicians were also required to spend an additional hour reviewing basic principles of pharmacy calculations and pass an examination with a score of 90% or above. Then, the CPS observed the employees in the clean room and assessed their aptitudes using gloved fingertip and media fill tests. The laboratory incubated these tests and results were reviewed by the CPS. Facilities performed adjustment to ensure pressure differentials in the clean room were adequate to maintain positive pressure and air quality as required for ISO classification. Most furniture made of particle board were replaced with stainless steel items. EVS scheduled daily cleaning of the floors in the clean room using

dedicated supplies. Seven months after the initial gap analysis, the CPS returned to the compliance study to evaluate these changes. The results showed that the pharmacy was compliant to 93% of the USP 797 standards.

Conclusion: The 2012 USP 797 compliance study was a useful tool in gauging the pharmacy compliance to sterile compounding regulations. Although the pharmacy department was able to dramatically improve its compliance to USP 797, the enhancements made were not sufficient to reach 100% compliance. This is due to budgetary constraints which prevent the facilities department from making additional, but costly, changes to the facility. With the increased scrutiny from boards of pharmacy, the FDA, and the DPH, hospital pharmacies should consider using the compliance study to identify areas of non-compliance and develop an action plan to remedy them.

Category: Quality Assurance / Medication Safety

Title: Achieving compliance to the joint commission medication management standard for the safe management of hazardous medications

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Purpose: The Joint Commission (TJC) released the latest edition to its medication management chapter in mid-2012. A community hospital performed a readiness review and identified a gap between the hospital processes and TJC standard for the safe management of hazardous medications. Those medications have one of the following six characteristics in humans or animals: carcinogenicity, teratogenicity/other developmental toxicity, reproductive toxicity, organ toxicity at low doses, genotoxicity, and structure and toxicity profiles of new drugs that mimic existing drugs determined hazardous by the above criteria. This compliance matter needed to be addressed in a timely manner to ensure continued TJC accreditation

Methods: A multidisciplinary team (including Pharmacy, Nursing, and Education) was tasked with reviewing the current recommendations on the safe handling of hazardous medications. The team reviewed the 2012 National Institute for Occupational Safety and Health (NIOSH) list of antineoplastics and other hazardous drugs in healthcare settings and compared it to the hospital formulary. The Pharmacy reviewed Material Data Safety Sheet (MSDS) and the package insert of each hazardous medication on the hospital formulary to identify the risk to personnel safety and create a pharmacists can reference to answer questions. Recommendations from organizations such as NIOSH, the Institute of Safe Medication Practices (ISMP), and the American Society of Health-System Pharmacists (ASHP) were assessed for potential implementation in the hospital. The most feasible safety strategies were forwarded to the Medication Safety Committee for implementation

Results: The Medication Safety Committee approved the implementation of four safety strategies. 91 hazardous medications were identified and an official list was created and posted on the intranet website and throughout the hospital. The electronic formulary was updated to include printable warning comments. The comments read: hazardous medication do not crush or split wear gloves. The Automatic Dispensing Machines (ADMs) were also updated to display the same warning message whenever a hazardous medication is removed. The provider is required to acknowledge this prompt before the medication can be removed. For medication dispensed from the Pharmacy, the medication is labeled with the patient label (with the warning comments) and a yellow auxiliary label. In the Pharmacy, all hazardous medications are segregated. Yellow bins are used to hold these medications and signage clearly demarcates this section. Hospital-wide education was provided to all personnel as these changes were made: nurses were instructed to recognize the warning labels, to take appropriate precautions, and to properly dispose of these medications; Pharmacy personnel was educated to take precautions when managing hazardous inventory, not to use the automatic pre-packing machine, to dispense all hazardous medications with the appropriate auxiliary labels, and reference accurate information to answer questions

Conclusion: Implementation of these strategies for the safe management of hazardous medications allowed the hospital to close the compliance gap with TJC medication management standards. However, the NIOSH list and the hospital formulary are regularly updated and timely process evaluations are required to ensure continuous compliance. And, random observation found that personnel do not consistently take required precautions when handling these medications. Continued education is needed to ensure compliance to established processes and TJC survey readiness

Category: Quality Assurance / Medication Safety

Title: Implementation of an automated technology to reduce medication errors and increase efficiency during emergency drug tray replenishment

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Purpose: The addition of new nursing units created an increased demand for emergency drug trays. The heightened workload associated with creating and maintaining these trays highlighted an inefficient, error prone process. This case describes how an automated technology for pharmacy trays and kits was selected, implemented, and monitored and demonstrates the effects on efficiency and medication safety.

Methods: A committee was established to investigate automated solutions to the tray replenishment process. The committee contacted a variety of automation vendors for demonstrations of their products. The product ultimately selected met the majority of the departmental technology goals previously defined as improving quality and safety, efficiency, compliance, security and employee satisfaction, and advancing clinical practice and sustainability. Medication errors, as well as time to replenish individual drug trays, were analyzed before and after implementation.

Results: The committee selected a radio-frequency identification (RFID) system. The time to complete an emergency drug tray was reduced from twenty minutes per tray to five minutes per tray. The medication errors decreased to a rate of one error per four thousand trays refilled.

Conclusion: The implementation of automated technology can assist with a reduction in medication errors and increased efficiency during emergency drug tray replenishment

