ASHP 2015 Midyear Meeting Professional Poster Abstracts

1-001

Category: Administrative practice / Financial Management / Human Resources

Title: Overcoming generic price increases at a tertiary care hospital

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Purpose: Over the past several years, the cost increases on a handful of generic medications has greatly outpaced the inflation of other medications. In some cases this increase has reached 6000%. Hospitals must quickly mitigate the increased prices or risk going over budget. In this large, tertiary care hospital, drug cost inflation is expected to increase expenditures by more than $2.5 million if left unchecked.

Methods: A monthly variance process is used to identify medications that have exhibited a significant price increases compared to their previous 12 month average. Once identified, usage patterns are analyzed and alternative approaches are developed with pharmacy, clinical leaders, hospital and corporate P&T Committees, and senior hospital leadership.

Results: To date during the fiscal year, no fewer than 10 of these generic price increases have been identified. For each of these, the approach to mitigate the impact has taken one of two tracks: formulary status modification or implementation of operational efficiencies. In several cases, adding or modifying formulary restrictions has helped to curtail usage. For example, after price increases with nitroprusside, restrictions on nicardipine infusions were lifted. Usage of nitroprusside dropped significantly and the switch is expected to save nearly $600,000 per year. In some cases, a drug is removed completely from the formulary, as was the case with phytonadione tablets, which will save $25,000 per year. In some cases, operational changes have made a significant impact. In the case of isoproterenol, a drug utilization review indicated that although significant amounts were used by occasional cardiac patients, the majority was used in electrophysiology studies, for which only a small portion of a vial was used. With support from the electrophysiologists, Pharmacy now makes a batch of a dilute solution. The vial may now be used in up to five patients instead of one patient, with projected savings of $1.1 million per year.

Conclusion: The rapid identification of price increases through variance analysis, coupled with the multidisciplinary approach of formulary modifications and implementation of operational

efficiencies, has helped mitigate the drastic inflation seen in recent years with generic medications.

1-002

Category: Administrative practice / Financial Management / Human Resources

Title: How fast is too fast? establishing operational workflow metrics to support patient safety and guide staffing patterns in an outpatient oncology pharmacy satellite

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Purpose: Oncology drug volumes at our outpatient oncology center have grown 47 percent since 2009, with a 22 percent increase in just the last 2 years alone. Our staffing patterns however have remained largely unchanged over time. Pharmacy literature lacks national benchmarking data to support a safe oncology product preparation rate. In an effort to better understand the time it takes to safely prepare a chemotherapy product, while also aiming to meet current and newly proposed regulatory standards, we sought out to establish appropriate pharmacy technician staffing ratios for the oncology satellite.

Methods: We conducted a prospective, observational study employing lean principles to evaluate medication preparation in the oncology satellite. Staffing needs were determined using the takt and cycle times to calculate a full time equivalent (FTE) ratio. The takt time represents the demand and drives the pace of the workflow. The cycle time represents the observed time to complete a task. We established our takt time using oncology volumes and current state technician staffing hours. Process flow maps were developed and used during the observation of pharmacy technicians to measure the average overall time required to complete several oncology products of varying admixture complexity to obtain the current and ideal state cycle times. The takt time and cycle times from these observations were used to calculate the ideal state FTE ratio, representing the staffing needs to address safety and regulatory gaps identified.

Results: Based on the takt time calculation, the current pace in our oncology satellite allows a technician only 14 minutes per order. In the ideal state observation, technicians required an average of 16.6 minutes to prepare oncology products. The calculated FTE ratio is 1.19, which means that in order to appropriately meet the demand, we would need an additional 14 hours of technician staffing per week (1.19 times the current staffing plan).

Conclusion: This calculation is helpful to determine staffing needs, and can be reproduced as needed. As volumes continue to grow, the takt time can be recalculated and applied. Similarly as new policies and procedures are developed which guide or influence workflow, the observation can be repeated and a new cycle time developed.

1-003

Category: Administrative practice / Financial Management / Human Resources

Title: Provision of pharmacy services to new rural health-system partners: client and employee perceptions and PPMI advancement

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Purpose: Telepharmacy allows pharmacists to provide pharmaceutical care to patients from geographically distant sites. Previous telepharmacy studies have found that nurse job satisfaction increases with these services while pharmacists that provide the service have decreased job satisfaction. The Pharmacy Practice Model Initiative outlines best practices for health-system pharmacy, and supports telepharmacy as a way to advance pharmacy practice. This study aimed to evaluate opportunities to advance pharmacy practice at a telepharmacy client site and to examine client nurses and employee pharmacist perceptions, attitudes, and satisfaction related to the provision of remote pharmacy services and how these change over time.

Methods: Two institutional review board approved surveys were developed to evaluate client and employee perceptions of service, operations, communication, and satisfaction related to the remote pharmacy services. There were eleven survey items for the client nurses to complete and twelve for the employee pharmacists. Survey links were sent electronically or paper copies were provided to eligible subjects in October 2014 and repeated in March 2015. Survey items scored on a five-point Likert scale from strongly disagree to strongly agree with space for optional comments. All responses were anonymous, and eligible subjects were able to decline participation. Additionally, the Pharmacy Practice Model Initiative Hospital Self-Assessment was conducted for the client site via in-person interview with the Director of Pharmacy.

Results: Thirty client nurses and fourteen employee pharmacists were eligible to complete the surveys. Seven survey responses were collected from both in October 2014, with fifteen nurse responses and twelve pharmacist responses in March 2015. Median survey responses revealed differences between the groups. Nurses agreed the services were efficient, high quality, helpful, and safe, and had increased satisfaction with the services over time. But, surveys also revealed nurses did not have positive interactions with the pharmacists and interventions were not viewed as useful. Pharmacists had operational and communication concerns that did not improve over time, and they were consistently dissatisfied with providing telepharmacy services. However, they believe they are improving patient care and medication safety, provide valuable services, and understand the strategic importance of providing telepharmacy services. The Hospital Self-Assessment score for the client site was less than 50 percent in all areas evaluated, with an

overall score of 35 percent for pharmacy advancement (below averages for similar hospitals, Iowa hospitals, and the national average). The results were used to develop an action plan to advance pharmacy practice. This included developing prospective medication-use evaluation programs, collaborative practice agreements, risk assessment tools, and a safety oversight team.

Conclusion: This study demonstrated that client nurses had dissatisfaction related to customer service but were satisfied with the remote pharmacy services overall. In contrast, employee pharmacists were dissatisfied with providing telepharmacy services, and had operational and communication concerns that were unaffected by increased repetitions over a six month period. Low performance by the client site on the Hospital Self-Assessment highlighted opportunities to advance pharmacy practice locally. Limitations of the study include small sample size, variable survey populations between the study periods, and limited interdisciplinary opinions to represent the client site.

1-004

Category: Administrative practice / Financial Management / Human Resources

Title: Development of a comprehensive clinical research pharmacist career ladder

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Purpose: The Research Pharmacy represents a unique area of pharmacy practice in that it serves both study subjects and the clinical research community. Pharmacists working in this specialty area must develop familiarity with the protocol approval process and the various regulations surrounding the distribution and control of research medications. Skill sets include a basic understanding of pharmacodynamics, administrative skills, working and communicating with study teams and assessing the appropriateness of patient care within the parameters of a research protocol. The Clinical Research Pharmacist Career Ladder recognizes individuals' professional development and growth as they progress throughout their careers at the Medical Center.

Methods: The Medical Center had an outdated and retired Career Ladder which was developed in 2005. Over the past 10 years, the responsibilities and structure of the Research Pharmacy has been redefined which necessitated a major overhaul of the program. The methods utilized to develop a new advancement program included: analysis of the Research Pharmacy demands, communication with members of the hospital community who have implemented successful career advancement programs, investigation of various career advancement plans in relation to the goals of the Research Pharmacy, review of personal career goals of the current staff, and review of the institution's mission statement and future goals. A statement of need was also developed. Specifically, it is in the best interest of the Research Pharmacy at BIDMC to provide employees with opportunities that allow for career growth. This will, in turn, enhance and support the department and hospital,and more importantly, the study subjects that we serve. The Cancer Clinical Trials Research Pharmacist worked closely with the Research Pharmacy Supervisor to develop a detailed proposal and presented it to Pharmacy Administration.

Results: A new three-tiered advancement program was developed which takes into account competency and leadership skills based on the development of five realms of practice: administration, education, evaluation, therapeutics, collaboration/teamwork. Growth within these five fundamental practice categories allows participants to achieve the following advancement levels: Clinical Research Pharmacist Level II (CRP II), CRP III and CRP IV. These advancement levels correspond to an expert level of advanced practice and are associated with incremental pay scale increases. The applicant must submit an Application of Intent Form to the Research Pharmacy Manager at least 2 months prior to submitting a formal application/portfolio for consideration. The formal application includes a personal statement that outlines achievements in each of the 5 realms, an attestation statement, supporting evidence for all activities completed, and blinded peer reviews to be chosen by the manager of record. Once a candidate has achieved

a promotion through the career ladder, they must submit documentation annually at the time of their performance evaluation substantiating their current advancement level. Pharmacists who fail to meet the minimum standard for their career ladder level at the time of their annual evaluation will be re-assigned one level below with resultant decrease in pay.

Conclusion: The Clinical Research Pharmacist Career Ladder is a comprehensive advancement program which effectually categorizes the goals of the department and helps guide employees in their aspirations for career growth. There is a clear and concise maintenance plan during the upward progression. There is also an accompanying advancement title and compensation package at each level of advancement which proportionately reflects the responsibilities, proficiencies, and skills of the new role. This innovative and realistic advancement program will promote career growth and provide the motivation and incentive needed to create effective, competent and loyal employees.

1-005

Category: Ambulatory Care

Title: Insulin glargine versus NPH insulin in the veteran population: a pilot study

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Purpose: This study aimed to determine the mean change decrease in hemoglobin A1c (A1c) from baseline to the first value captured after six months of initiation with insulin glargine versus NPH insulin in Veterans with type 2 diabetes mellitus 65 years of age at the Providence VA Medical Center (PVAMC).

Methods: A retrospective observational study was performed via electronic chart review on Veterans 65 years of age at the PVAMC with type 2 diabetes mellitus, currently using insulin aspart and metformin that were initiated on insulin glargine or NPH insulin from September 1, 2008 to September 1, 2014. The cohort was divided into two groups corresponding with the basal insulin in use. The mean change decrease in A1c was determined using a t- test by comparing the baseline A1c with the first A1c value captured six months after basal insulin initiation. Using a Chi-squared test, we assessed the percent of Veterans at age-related A1c goal 12 months after initiation with the respected insulin therapy.

Results: There were clinically significant mean change decreases in A1c in each basal insulin group from baseline to the first value captured after 6 months. Amongst comparator groups, NPH insulin resulted in a greater mean change decrease in A1c compared to insulin glargine (-0.994 vs. -0.688; P = 0.30), though this value was not statistically significant. For secondary outcomes, more Veterans in the NPH insulin cohort met age-related A1c goal after 12 months of therapy compared to insulin glargine (35.3% vs. 18.6%, P= 0.07).

Conclusion: NPH insulin appears to provide a greater mean change decrease in A1c over time resulting in more patients achieving age-related A1c goals after 12 months of therapy compared to insulin glargine in Veterans 65 years old at the Providence VA Medical Center.

1-006

Category: Ambulatory Care

Title: Analysis of hypertension and diabetes management in veterans transitioned from face-to-face to telephone anticoagulation clinic

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Purpose: The Jesse Brown Veterans Affairs Medical Center Pharmacy Service offers both face-to-face (FTF) and telephone anticoagulation monitoring services. The focus of the FTF anticoagulation visits is on disease state management as a whole, and includes clinical management of chronic disease states. Upon transition to the telephone anticoagulation clinic, the focus of the visit shifts to the patient's anticoagulation regimen. The purpose of this study is to evaluate what impact the transition from FTF to telephone anticoagulation clinic has on the clinical management of hypertension and diabetes in patients receiving pharmacist-managed chronic warfarin therapy.

Methods: This Institutional Review Board- and Veterans Affairs Research and Development Committee-approved retrospective, case-control study evaluated patients receiving warfarin who were transitioned from FTF to telephone clinic anytime between May 1, 2008 and September 1, 2013. Patients who had hypertension and/or diabetes and had adequately documented monitoring parameters for these disease states were included. The primary objective was to compare the degree of change in the patient's blood pressure and hemoglobin A1c in the year prior to and the year following clinic transition. Secondary objectives included a clinical comparison of the results to evidence-based treatment guidelines, healthcare utilization rates, and major cardiovascular event rates.

Results: The mean blood pressure was 123/71mmHg one year prior to clinic transition, 124/68mmHg at the point of transition, and 122/67mmHg one year following clinic transition. The mean hemoglobin A1c was 7.5% one year prior to clinic transition, 7.7% at the point of transition, and 7.7% one year following clinic transition. The changes in systolic and diastolic blood pressure in the year following the clinic transition date (CTD) were statistically similar to those in the year prior to the CTD. The changes in hemoglobin A1c in the year following the CTD were also statistically similar to those in the year prior to the CTD. In addition, the type of anticoagulation clinic did not have a significant impact on the rates of blood pressure and hemoglobin A1c values at therapeutic goal. There was also no statistically significant difference in healthcare utilization and major cardiovascular event rates between the two time periods/anticoagulation clinics.

Conclusion: This retrospective, case-control study demonstrated that the transition from FTF to telephone anticoagulation clinic does not appear to have had an impact on the clinical

management of hypertension and diabetes at our facility. Furthermore, the current strategy for identifying possible patients for transition to telephone anticoagulation clinic is appropriate for our current patient population.

1-007

Category: Ambulatory Care

Title: Specialty pharmacy assessment of health literacy in a diverse, underserved patient population

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Purpose: Specialty Pharmacy Services (SPS) is a health-system based specialty pharmacy at the University of Illinois Hospital and Health Sciences System. URAC Specialty Pharmacy Accreditation requires a health literacy assessment for patients upon enrollment in SPS. Health literacy is defined by the Institute of Medicine as the degree to which individuals have the capacity to obtain process and understand basic information and services needed to make appropriate decisions regarding their health. Nearly 90 million U.S. adults are estimated to be at risk for low health literacy. Factors such as a patients age, ethnicity, educational and socioeconomic level contribute to health literacy.

Methods: To meet this standard, SPS adopted two health literacy assessment tools, one for face-to-face assessment and the other telephonic, to determine patients health literacy level and better address the needs of our population. SPS administered the validated in-person Rapid Estimate of Adult Literacy in Medicine - Revised (REALM-R) or the telephonic CHEW 3-Item test on all new patients starting in April 2015. Upon completion of the test, patients were designated either Normal or At Risk for low health literacy in the SPS case management system. SPS staff used various approaches to optimize patient comprehension. All approved patient materials were written at an eighth grade reading level. Patients were surveyed and counseled monthly, and were assessed for medication adherence, tolerability, correct administration, and satisfaction.

Results: As compared to the general 2010 US Census Data, the UI Health Primary Service Area consists of a greater proportion of patients who are younger, non-Caucasian, undereducated, or living below the poverty level. Among patients aged 18-64 years, 37% reported having commercial insurance, while about 32% had public insurance (Medicaid and Medicare), and 31% were uninsured. The REALM-R and CHEW 3-Item tests were administered to 82 patients enrolled in SPS during April and May 2015. Thirty seven patients (45%) were identified to be at risk for low health literacy, which is in line with estimates of the U.S. adult population. Based on these results, SPS is starting to incorporate tools such as medication administration videos, injection site pictures and diagrams, and availability of weekly to monthly pillboxes into our practice model. In the future, outcomes will be reported that compare at risk with normal health literacy patients for medication adherence, tolerability, correct administration, and satisfaction.

Conclusion: SPS manages patients with high-cost specialty medicines used in the treatment of rare or chronic and complex diseases such as hepatitis C, rheumatoid arthritis, multiple sclerosis, and pulmonary arterial hypertension. The integration of health literacy has become part of the daily practice at SPS. Involvement in the URAC Specialty Pharmacy Accreditation process led to integration of health literacy assessments into our case management system. This process can be incorporated into other health-system based specialty pharmacies and is particularly useful in the SPS patient population.

1-008

Category: Ambulatory Care

Title: Reasons for unexpected loss of housing for homeless veterans: a pilot study

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Purpose: A key priority for the current administration and the Veterans Health Administration is ending homelessness among Veterans by 2015. Towards this goal, significant progress has been made with a greater than 30% decline in Veteran homelessness, and over 40% decline in chronic homelessness1,2 Reducing recidivism back to homelessness is a key component to the success of the Veterans Affairs initiative to end homelessness.

Methods: A retrospective chart review of 50 consecutive patients who had a forced or unplanned discharge from Gateway-to-Independence transitional housing due to program noncompliance. The chart review is comprised of data for the three months preceding housing loss.

Results: Of the total 50 patients, 34% lost housing due to alcohol abuse, 30% for rules violation, 30% for substance abuse, 12% for an altercation, and 8% for other reasons. Medication use: of the total 50 patients, 62% on psychiatric, 52% on pain, 28% on cardiac, 10% on endocrine, and 10% on respiratory medications. Out of the 50 patients, 64% attended at least 1 primary care visit, 50% used the emergency department at least once, and 18% had an inpatient hospitalization. For mental health appointments 32% attended at least one individual and 8% attended at least one group appointment. For substance abuse appointments, 40% attended at least one individual and 34% attended at least one group appointment. Lastly, 86% of patients had at least one specialty care appointment. There were 30 (60%) patients on at least one psychiatric medication prior to loss of housing, with 24 (80%) of them refilling their prescriptions. Twenty-nine patients out of the 50 had at least one pain scale recorded with only eight (27%) having had a pain scale score of 5 at multiple visits. All eight patients (100%) with pain scores of 5 were on pain medications.

Conclusion: Non-compliance with medications did not trend towards substance abuse or alcohol related housing discharge, however it may trend towards altercation or rules violation leading to program discharge. Patients with uncontrolled pain may be associated with housing loss due to alcohol/substance abuse. And lastly, patients were primarily utilizing primary care and specialty appointments versus mental health and substance abuse visits which may warrant further investigation to improve care.

1-009

Category: Ambulatory Care

Title: Respiratory synctial virus (RSV) season is here: an efficient process in providing specialty medication to local and off-site clinics

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Purpose: Respiratory Synctial Virus (RSV) strikes Illinois and the Midwest between October and April every year. Infants and children that are born prematurely are at highest risk because of underdeveloped lungs for developing RSV. The CDC recommends treatment of this sensitive pediatric patient population with Synagis (palivizumab). The purpose of this poster is to summarize and describe a model for a Federally Qualified Health Center (FQHC) contract pharmacy to prepare, label and provide all Synagis medication needs to the Main site clinic, as well as 3 off-site FQHC clinics, delivered via medical temperature monitored courier, for patient specific administration.

Methods: Patient is discharged from the NICU and receives the first dose of Synagis prior to going home. During the discharge process, patients parent chooses FQHC as the primary care clinic. The NICU or Pediatric clinician sends patient referral for Synagis via electronic chart messaging to designated personnel in FQHC contract pharmacy. Pharmacy personnel proactively obtain prior authorization forms from all Medicaid, Managed Medicaid, and private insurance plans in order to initiate the prior authorization process. Once a patient begins follow up at an off-site clinic and qualifies for Synagis, the provider sends a referral via electronic chart messaging and the pharmacy initiates the prior authorization process. Upon confirming approval of prior authorization from specific insurance plan, designated clinic staff picks up medication on day of injection for patients being seen at main site clinic. For off-site visits, delivery is handled with a specialty medication delivery service, with proper refrigeration and temperature monitoring within the transport vehicle since Synagis has specific storage requirements. Specialty medication delivery service arrives at pharmacy for pick up and transports medication to designated off-site clinic in a timely manner.

Results: This full circle collaboration between an FQHC contract pharmacy and clinic staff allows for a mechanism of completing prior authorizations as well as delivering Synagis to off-site clinics for the best patient care. It was determined that the main site FQHC contract pharmacy was best equipped to provide this specialty injectable medication to off-site clinics. The FQHC contract pharmacy was able to have medication delivered via medical temperature monitored courier. Overall, a model of an FQHC contract pharmacy prepared specialty medication was designed and implemented successfully for affiliated off-site clinics as well as the main site medical center. Specifically, patients seen at off-site clinics did not have to concern

themselves with making a trip to the main site pharmacy and putting their child at further risk with travel.

Conclusion: An FQHC contract pharmacy is best equipped to meet the recommendations of CDC guidelines for the specialty drug, Synagis. All medications were delivered in a timely and efficient manner, allowing patients access to quality care and further contributing to positive outcomes such as decreasing the risk of RSV in this sensitive patient population.

1-010

Category: Ambulatory Care

Title: Utilizing pharmacy extern assistance in obtaining ninety day supply prescriptions to bridge patient care

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Purpose: The finance department of a Federally Qualified Health Center (FQHC) contract pharmacy was pending contract approval with a major pharmacy insurance company. With the contract expiration only 2 weeks away, there was no definitive timeline on how long the approval of the pharmacy contract may actually take. Over 150 patients would potentially be affected during this period. This would indisputably disrupt patient care as well as cause them to transfer medications to surrounding pharmacies. In trying to prevent the loss of a huge number of patients and keeping continuity of care, the pharmacy extern was recruited onto this project.

Methods: The Pharmacist-In-Charge (PIC) and pharmacy staff recruited assistance from the pharmacy extern who ran a report through the pharmacy system database to determine all patients enrolled in the affected insurance plan. This particular insurance plan typically limits quantity of medications to 30 day supply for patients, with 90 day supply only approved with a prior authorization. First task in this process was to initiate contact with all providers by the pharmacy extern for 90 day supply prescriptions so as not disrupt the care of patients. Upon receipt of prescriptions, requests were submitted by pharmacy extern to the insurance company for a one time approval of 90 day supply medications. Once approved, the pharmacy extern and staff ordered the necessary medications and managed the inventory accordingly. As each approval for a one-time 90 day supply approval was given by the insurance company, all patient orders were prepared accordingly. Upon completion of preparing the patients medication order, the pharmacy extern contacted each individual patient to inform them of the 90 day supply approval as well as the situation with the pending pharmacy contract approval.

Results: There was no disruption in care for patients while awaiting pending pharmacy contract approval of insurance plan. Of the over 150 potential patients that would have been affected, only a few did not pick up their 90 day supply by their own choice. Most patients picked up their medications in a timely manner and further appreciated the effort put forth by the pharmacy to retain their business. All stock and inventory that was ordered specifically to meet the needs of the 90 day supply approval was used up appropriately. This project overall led to no extra inventory remaining on the shelf. The pharmacy contract was eventually approved through the finance department. Patients did not have to transfer out medications and continuity of care was kept in their primary site of care.

Conclusion: Assistance of a pharmacy extern is extremely helpful when problematic situations develop, especially in this case where patient care may have been disrupted. By proactively reaching out to providers, the insurance company, as well as patients the pharmacy extern helped to alleviate many disruptions in patients medication compliance as well as disruption in patient care that may have occurred. Patients did not go without their medications, received a 90 day supply as authorized by their provider, and no disruption in patient care occurred.

1-011

Category: Ambulatory Care

Title: Integrating pharmacy students to educate patients on immunizations at a federally qualified health center (FQHC) contract pharmacy

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Purpose: In an effort to prepare a Federally Qualified Health Center (FQHC) contract pharmacys first immunization clinic within the pharmacy, assistance was recruited by pharmacy students. The FQHC contract pharmacy wanted to determine the effectiveness of integrating pharmacy students in providing education verbally as well as with written materials on the importance of the influenza vaccine and other immunizations to its indigent patient population. In order to highlight the significance of vaccinations in preventive health care to its patients, the FQHC contract pharmacy decided to utilize pharmacy students from its local pharmacy school.

Methods: First step in hosting the vaccine clinic at the FQHC contract pharmacy was to ensure proper staff education. This thorough education of pharmacists, technicians, and externs was completed by the departments Immunization Director. The FQHC contract pharmacy advertised its services to the community through patient outreach. Pharmacists at the FQHC contract pharmacy received a standing order for immunizations signed by the FQHC physician and site Director. The standing order included the following immunizations: Influenza (age 10), Shingles, Hepatitis A, Hepatitis B, Hepatitis A and B, HPV, Meningitis, Pneumococcal, Tdap, and Td. First through third year pharmacy students set-up educational tables near the pharmacy, which included poster boards, brochures, pamphlets, and take home material to provide verbal and written educational information to patients. All pharmacy patients were screened for appropriate immunizations. Patients also received education on all immunizations via VIS and were especially encouraged to get the influenza vaccine as recommended by CDC guidelines.

Results: The FQHC main site clinic identified all qualifying patients visiting the clinic just for immunizations and directed them to the pharmacy where patients were educated by pharmacy students about various vaccines specifically the influenza vaccine. Patients arrived with a written or verbal request from the clinic for the needed vaccination. In addition to referrals from the clinic, pharmacy students and staff members also screened all pharmacy patrons for qualifying immunizations. This unique arrangement freed up time for clinic staff (nurses and providers), increased the number of immunizations given in the pharmacy, and increased further education regarding immunizations to the patients. Patients not only received their appropriate vaccinations, but received additional counseling from pharmacists, as well as education from pharmacy students.

Conclusion: Patients became better informed about various immunizations and the importance of staying up to date on them through the help of pharmacy students. Patients understood and gained a greater appreciation for the role of pharmacists and pharmacy students in giving immunizations and education regarding immunizations respectively. Clinic staff were able to send all immunization referrals directly to pharmacy, which in turn, freed up their time and allowed the pharmacy to capture more patients for immunization.

1-012

Category: Ambulatory Care

Title: Sitagliptin and cardiovascular outcomes in patients with type two diabetes mellitus (T2DM)

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Purpose: Dipeptidyl peptidase-4 Inhibitors (DPP4-I) are among one of several classes of adjunct oral therapy for T2DM. Previous study revealed that use of saxagliptin, a DPP4-I, was correlated with an increased rate of hospitalization for heart failure, but did not increase rate of cardiovascular (CV) events. Currently, it is unknown if sitagliptin, another DPP4-I, is also associated with heart failure exacerbation and/or CV event(s). The primary objective is to examine whether there is an association between sitagliptin and CV morbidity (CV-related admissions and CV-related clinic visits). The secondary objective is to evaluate all-cause mortality of patients taking sitagliptin.

Methods: This is a retrospective chart review and data analysis study. Patients who received a new prescription of sitagliptin for a minimum of 90-day supply between June 1, 2010 and June 1, 2014 were included in the study. Patients with a history of use of other DPP4-Is or incretin-based therapy, estimated glomerular filtration rate (eGFR) less than 30 mL/min, renal transplantation, or chronic hemodialysis were excluded. Adjusted Cox proportional hazards models were utilized to analyze the relationship between patient specific factors and sitagliptin day supply to study outcomes. Patient specific factors comprised of age, body mass index, gender, new CV-related clinic visits for stroke, coronary artery disease (CAD), myocardial infarction (MI), heart failure (CHF), and angina. Study outcomes were defined as general hospital admission, CV-related admission, CHF admission, and all-cause mortality.

Results: A total of 905 patients were included. The mean sitagliptin day supply was 536.6 days [plus or minus standard deviation (SD) 415.1]. Of the study population, 163 patients (18.0 percent) were admitted for general hospital admissions with 25 patients (2.8 percent) admitted for CV-related admissions and 10 patients (1.1 percent) admitted for CHF admission. All-cause mortality occurred in 58 patients (6.4 percent). Cox proportional hazards models, adjusted for patient specific factors listed in the methodology revealed that age, stroke, CAD, MI, CHF, and angina were significant factors associated with sitagliptin day supply and event outcomes. For general hospital admission, age [hazard ratio (HR) 0.98, 95 percent confidence interval (95% CI), 0.96-1.00, P=0.03], CAD (HR 1.75, 95% CI,1.03-2.98, P=0.04), angina (HR 2.42, 95% CI,1.07-5.46, P=0.03) were significant. For cardiovascular-related admission, CAD (HR 4.23, 95%CI ,1.10-16.36, P=0.04), and CHF (HR 8.58, 95%CI, 2.85-25.86, P<0.01) were significant. For CHF admission, age (HR 1.17, 95%CI, 1.03-1.33, P=0.01), CAD (HR 8.78, 95% CI, 1.29-

59.61, P=0.03), MI (HR 166.77, 95% CI,7.85-3543.71, P less than 0.01), CHF (HR 54.98, CI=6.01-503.19, P less than 0.01), and angina (HR 72.57, CI=2.64-1996.52, P=0.01) were significant. Lastly, for all-cause mortality, stroke (HR 3.44, 95%CI, 1.44-8.20, P less than 0.01) was significant.

Conclusion: The study results suggested that the use of sitagliptin may be associated with cardiovascular outcomes, general hospital admission, and all-cause mortality. In addition, the results suggested that sitagliptin use should be monitored closely in patients at risk for cardiovascular morbidity.

1-014

Category: Cardiology / Anticoagulation

Title: Characterization of anticoagulation use in a safety net population of female patients with atrial fibrillation

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Purpose: The CHA2DS2-VASc score is now the preferred risk stratification tool to determine those patients who would derive the most benefit from anticoagulation. All female patients will receive a CHA2DS2-VASc score of at least 1. Patients with a CHA2DS2-VASc score of 1 are recommended to receive no anticoagulation when female gender is the only risk factor. Patients with a score of 2 should receive either warfarin or a non-warfarin oral anticoagulant (NOAC). Our objective was to characterize the current use of antithrombotic therapy in our female population with atrial fibrillation stratified by CHA2DS2-VASc score.

Methods: We identified 373 female patients diagnosed with AF who attended one or more primary care visits over a two-year period within an integrated safety net health care system. We risk stratified patients using the CHA2DS2-VASc scoring systems as low- (score of 1) or high-risk (score 2).

Results: Of the 373 female patients, 7% (N=26) were low-risk and 93% (N=347) high-risk. Low-risk patients received: 65% (N=17) no antithrombotic therapy, 19% (N=5) antiplatelet monotherapy, 12% (N=3) warfarin monotherapy, and 4% (N=1) warfarin plus antiplatelet. High-risk patients received: 9% (N=31) no antithrombotic therapy, 22% (N=76) antiplatelet monotherapy, 6% (N=20) dual antiplatelet therapy, 27% (N=94) warfarin monotherapy, 30% (N=105) warfarin plus antiplatelet, 1% (N=4) NOAC monotherapy. The remaining 5% (N=17) received other combinations of antithrombotic agents.

Conclusion: In a safety net population of female patients with atrial fibrillation, a majority of low-risk patients were treated in a guideline-concordant manner whereas only 28% of high-risk patients were treated with warfarin or NOAC monotherapy. The remaining 72% received potentially inappropriate mono- or combination antithrombotic therapy. This demonstrates the need for a systematic approach to risk stratification and initiation of appropriate anticoagulation therapy in female patients with atrial fibrillation.

1-015

Category: Cardiology / Anticoagulation

Title: Impact of a Pharmacist-Led Direct Oral Anticoagulant Service

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Purpose: To determine the impact of a pharmacist-led direct oral anticoagulant (DOAC) service on prescription appropriateness, patient adherence, and adverse events as compared to usual care.

Methods: We performed a retrospective, observational, matched cohort analysis of patients initially prescribed a DOAC by a provider at a large academic medical center between September 20, 2013 and December 31, 2014 after receiving Institutional Review Board approval. We compared a group of patients (n=129) age 18 or older who participated in a pharmacist-led DOAC service to a similar group (n=132) who received usual care. Coarsened exact matching based on specific DOAC, age, and indication for anticoagulation was used to identify the usual care group. The co-primary endpoints were the percentage of patients who had appropriate DOAC therapy (FDA-approved medication and dose based on indication and renal function) prescribed at baseline and at follow up after 3 to 6 months. Unadjusted analyses were performed using Chi squared tests. Odds of appropriate medication regimens were assessed using multivariable logistic regression models including enrollment in the pharmacist-led service, baseline renal function, and cardiologist as the prescribing provider. Adverse events including major bleeding and venous thromboembolism during the study period were reviewed and descriptively reported.

Results: Patients in the pharmacist-led DOAC service were significantly more likely to have an appropriate DOAC and dose prescribed for their indication at baseline as compared to the usual care group (92.2% vs. 77.3%, p = 0.001; adjusted odds ratio [aOR] 3.1, 95% CI 1.41-6.84). This finding persisted at 3-6 month follow up for the pharmacist-led DOAC service (93.8%) vs the usual care group (80.8%), (p=0.002; aOR=3.02, 95% CI 1.27-7.17). There was no difference between groups in terms of the number of patients determined to have an appropriate DOAC prescribed (independent of dose) for an FDA-approved indication in the pharmacist-led service (95.3%) vs the usual care group (93.2%) at baseline (p>0.3; aOR 1.18, 95% CI 0.38-3.69). Four patients experienced gastrointestinal bleeding during the course of the study (one in the pharmacist-led DOAC service and three in the usual care group). There was one thromboembolic event (ischemic stroke) in the usual care group which was attributed to patient self-discontinuation of therapy.

Conclusion: Pharmacists and other health care providers are equally able to select a DOAC based on appropriate indications. However, a pharmacist-led DOAC service increases appropriate dosing of DOAC therapy at baseline and follow up. The impact of a pharmacist-led DOAC service on medication adherence remains to be investigated.

1-016

Category: Cardiology / Anticoagulation

Title: Plasma concentrations of rivaroxaban after gastric bypass surgery: a case report

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Case Report: Rivaroxaban is an oral direct factor Xa inhibitor approved for prevention of stroke in patients with atrial fibrillation (AF). Rivaroxaban is rapidly absorbed in the upper gastrointestinal (GI) tract, reaching maximum concentration in 2-4 hours. The pharmacokinetic profile for rivaroxaban in clinical trials was shown to be consistent across a variety of patient populations. However, it is unknown if gastric bypass reduces rivaroxaban absorption, which may result in inadequate anticoagulation. This case report describes the use of rivaroxaban in a patient status-post proximal Roux-en Y gastric bypass surgery with AF and high risk of stroke, including history of a transient ischemic attack (TIA). The patient is a 60-year-old female diagnosed with AF in 2008, initially anticoagulated with the vitamin K antagonist (VKA) warfarin, which she discontinued in 2009. She underwent gastric bypass surgery in 2010. Anticoagulation was restarted with rivaroxaban 20 mg daily in September 2013 after diagnosis of a TIA; she has not had a recurrent thromboembolic event since that time. To determine the potential effects of gastric bypass on drug concentration levels in this patient, plasma concentrations of rivaroxaban were measured using a calibrated chromogenic anti-Xa assay. Trough plasma concentration, international normalized ratio (INR), and prothrombin time (PT) were collected 23 hours after intake of rivaroxaban 20 mg and were < 30 mcg/ml, 1.01, and 11.3 seconds, respectively. Peak plasma concentration, INR, and PT were collected two hours after intake of rivaroxaban 20 mg and were 275 mcg/ml, 1.50, and 16.7 seconds, respectively. Increased INR and prothrombin time qualitatively confirm the presence of rivaroxaban, and the measured peak concentration after a 20 mg dose of rivaroxaban was in the expected range compared to published data. Therefore, it was concluded that rivaroxaban absorption was immediate and not reduced in this patient after gastric bypass.

1-017

Category: Cardiology / Anticoagulation

Title: Outcomes associated with implementation of a bleed risk assessment tool on percutaneous coronary intervention anticoagulation

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Purpose: Unfractionated heparin and bivalirudin are two of the most common antithrombotic drugs utilized during percutaneous coronary intervention (PCI). Bleeding events are one of many potential complications of these procedures, and the optimal use of these agents to reduce bleeding events is unknown. The purpose of this study was to assess prescribing patterns of heparin and bivalirudin, access site utilization, and bleeding events prior to and after the implementation of a validated bleed risk tool.

Methods: This institutional review board approved study was a retrospective analysis occurring before and after the implementation of a bleed risk assessment tool validated by the National Cardiovascular Data Registry. Adult patients greater than or equal to 18 years of age who underwent PCI were included in the study. Patients who had an allergy to heparin or bivalirudin, as well as patients who were prisoners at the time of PCI were excluded. Included patients were retrospectively stratified as low, medium, or high risk of bleeding based on the bleed risk assessment tool. The primary objective was to assess heparin and bivalirudin prescribing patterns prior to, and after the implementation of a validated bleed risk assessment tool. Secondary objectives included a comparison of the incidence of post-PCI bleeding events that occurred within 72 hours of PCI prior to and after implementation of the tool. Radial and femoral access site utilization was also evaluated.

Results: There were 678 patients included in the analysis prior to implementation, and 48 patients included after. Heparin use occurred in 69 percent of cases prior to implementation of the bleed risk assessment tool and 90 percent after. Radial artery access site use increased in all risk categories after tool implementation. Preliminary data indicates that bleeding events occurred in 3.8 percent of cases before implementation, and zero cases after implementation of the tool.

Conclusion: The utilization of a bleed risk assessment tool has allowed for a more individualized approach to PCI anticoagulation. Bivalirudin use has decreased and heparin use has increased. The use of radial artery access site has also increased. A decreasing trend in the incidence of bleeding events has also occurred after tool implementation.

1-018

Category: Cardiology / Anticoagulation

Title: Retrospective chart review of veteran patients converted from bumetanide to furosemide for the treatment of heart failure

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Purpose: Diuretics play a fundamental role in the management of heart failure (HF) and loop diuretics remain the cornerstone of treatment for symptoms of congestion. Pharmacokinetic differences among the loop diuretics, especially bioavailability, may potentially contribute to HF hospitalizations and readmissions. Due to a nationwide drug shortage of oral bumetanide in February 2014, patients at the Jesse Brown Veterans Affairs Medical Center (JBVAMC) were converted from bumetanide to furosemide. The purpose of this study was to evaluate the clinical effects of changing drug therapy from oral bumetanide to oral furosemide in veterans with HF at JBVAMC during the bumetanide shortage.

Methods: The institutional review board approved this retrospective, cross-over, electronic chart review. Subjects at least 18 years old with an active bumetanide prescription in February 2014 were evaluated for inclusion. Exclusion criteria were: subjects not switched to furosemide during the shortage, on bumetanide for an indication other than HF, or did not receive care at JBVAMC. Subject charts were accessed up to three months before and after the conversion. The primary outcome was the difference in the number of HF decompensations in subjects before and after the conversion from bumetanide to furosemide. HF decompensations were defined as admission for a HF exacerbation, emergency room or urgent care visit for worsening HF symptoms, or clinic visit with documented worsening HF symptoms which required one of the following interventions: an increase diuretic dose, conversion to a different loop diuretic, or addition of a thiazide diuretic. Secondary outcomes were each of the separate decompensations. Subgroup analyses were performed in subjects with specific baseline characteristics: low albumin (< 3.4), chronic kidney disease stages III-IV, stable dose of bumetanide prior to conversion, evidence-based medications in subjects with ejection fraction less than 40%, compliant with both diuretics, and bumetanide therapy for three months prior to the conversion.

Results: Of the 203 subjects at JBVAMC with an active outpatient prescription for bumetanide at the time of conversion, 82 subjects were included in the final analysis. The mean age of subjects was 69 years, 81% were African American, and all were male. For the primary outcome, there were 40 decompensations on bumetanide compared to 52 decompensations on furosemide (p=0.14). There were 16 hospital admissions on bumetanide and 16 on furosemide (p=1.0), 5

emergency room or urgent care visits on bumetanide and 9 on furosemide (p=0.16), and 20 clinic visits with an intervention on bumetanide and 28 on furosemide (p=0.25). In the only subgroup analysis that reached statistical significance, there were a total of 5 decompensations in the bumetanide group compared to 29 in the furosemide group ($p < 0.001$) for subjects on a stable dose of bumetanide prior to conversion (n=58).

Conclusion: This study found no difference between the number of HF decompensations in patients converted from bumetanide to furosemide. In a subgroup analysis, statistically more decompensations occurred after conversion to furosemide in subjects on a stable dose of bumetanide prior to conversion. This is clinically relevant as it reflects a well-designed trial in which the bumetanide dose required for each subject would have been established prior to conversion. The conversion from bumetanide to furosemide was well-tolerated in patients at JBVAMC, but larger prospective studies are needed to confirm there is no difference in clinical outcomes with bumetanide compared to furosemide.

1-019

Category: Cardiology / Anticoagulation

Title: Thromboembolic and bleeding outcomes of veterans from the San Francisco Veterans Affairs Health Care System (SFVAHCS) treated with target-specific oral anticoagulants (TSOACS)

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Purpose: Warfarin has been the standard therapy to prevent and treat thromboembolic events. The monitoring requirements and multiple drug and food interactions associated with warfarin led to the development of target-specific oral anticoagulants. Prescribing information indicates routine monitoring is not required for these agents. At the San Francisco Veterans Affairs Health Care System, the Anticoagulation Service evaluates if patients are candidates for these agents. If approved, this service closely monitors eligible patients, indefinitely. This study was developed to evaluate the efficacy and safety outcomes of veterans who are closely monitored while receiving target-specific oral anticoagulants for atrial fibrillation or venous thromboembolism.

Methods: This study was approved by the institutional review board. It consisted of a retrospective chart review that included veterans prescribed dabigatran, rivaroxaban, or apixaban between April 1, 2011 and August 31, 2014 for the acute management or secondary prevention of a venous thromboembolism or the prevention of atrial fibrillation induced thromboembolic events. Patients were excluded if they received any of the three drugs for the primary prevention of a venous thromboembolism, obtained primary care outside of the study institution, or had sensitive medical records. Electronic medical records were reviewed for bleeding and thromboembolic complications for up to one year after medication initiation at the study institution. Medication adherence was assessed by provider notes and refill history. The primary outcome was the frequency of combined thromboembolic and bleeding events in patients initiated on target-specific oral anticoagulant therapy. Secondary outcomes consisted of the frequency of thromboembolic events, the frequency of major and non-major bleeding complications, and the frequency of inappropriate dosing of target-specific oral anticoagulants.

Results: Two-hundred fifteen patients were included in the study. Seven (3.3 percent) patients experienced thromboembolic or bleeding complications. Two (0.93 percent) patients had a thromboembolic event. No patients had a major bleeding event while five (2.5 percent) patients had a non-major bleeding event, primarily characterized by gross hematuria. Ninety-seven percent of the patients were on appropriate target-specific oral anticoagulant dosing regimens and 85 percent of the patients appeared to be adherent to their target-specific oral anticoagulant regimen.

Conclusion: The results of this single-centered retrospective pilot study suggest that veterans on target-specific oral anticoagulants at the San Francisco Veterans Affairs Health Care System have a low frequency of thromboembolic and bleeding events. Routine monitoring and follow-up of veterans on target-specific oral anticoagulants may have contributed to the low incidence of complications, but further studies are needed to confirm these findings.

1-020

Category: Cardiology / Anticoagulation

Title: Incidence of thrombocytopenia after induced hypothermia for cardiac arrest

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Purpose: Induced hypothermia (IH) is used to improve neurologic outcomes in comatose adult patients with return of spontaneous circulation after cardiac arrest. Many complications are associated with IH, including hyperglycemia, electrolyte disturbances, bleeding, shivering, leukopenia, pyrexia after rewarming, and infections. Thrombocytopenia has been observed following IH in severe brain injury patients. The purpose of this study was to investigate the association between IH for cardiac arrest and the incidence, significance, and duration of thrombocytopenia.

Methods: The institutional review board approved this single-center retrospective cohort analysis of adult survivors of cardiac arrest treated with IH, conducted from 2009 to 2013. Serial measurements of platelet counts were assessed for 7 days after the IH protocol was completed. The primary outcome was the incidence of thrombocytopenia, defined as a platelet count of less than 150,000 per milliliter. Secondary outcomes included the average platelet decline in patients who developed thrombocytopenia and duration of thrombocytopenia.

Results: Thrombocytopenia occurred in 68 percent of patients. Platelet counts declined an average of 43 percent (P value less than 0.001) in the patients who developed thrombocytopenia. Platelet counts returned to baseline in 75 percent of patients within 5 days.

Conclusion: Thrombocytopenia was a common occurrence in our cohort. Clinicians should be aware of this potential reaction when assessing hematologic values after induced hypothermia for cardiac arrest.

1-021

Category: Critical Care

Title: Evaluation of critical care education in U.S. colleges and schools of pharmacy

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Purpose: While there is no standard definition for critical care pharmacist activities, the American College of Clinical Pharmacy and Society of Critical Care Medicine have proposed a scope of practice and standardized services. The extent to which these skills are being taught and assessed in pharmacy education remains unknown. The purpose of this study was to determine the nature and extent of critical care education in U.S. colleges and schools of pharmacy.

Methods: This was an IRB-approved, multicenter, survey research study of faculty members, department chairs and/or administrators at candidate or accredited schools and colleges of pharmacy who teach, coordinate or approve critical care-related pharmacy curricula. The survey included program demographics and characteristics, the location of 37 core critical care topics within the curriculum and the teaching and learning methods and contexts utilized to teach each area. The survey structure utilized skip logic, which directed the respondent through different paths in the survey based on previous responses. The survey link was emailed to the curriculum American Association of Colleges of Pharmacy list-serve via Qualtrics (Provo, UT) with instructions for the recipient to complete or forward to the appropriate individual with close knowledge of this area within the curriculum. Participants identifying information remained anonymous. Participants completed surveys between January and June 2015. Frequency and descriptive statistics were used to characterize the specific topics, extent, and methods of content delivery for critical care topics in the curriculum.

Results: Respondents from 81 of 138 schools of pharmacy (58.7%) completed the survey in its entirety. Respondents came from a mix of private (52%) and public (48%) institutions with a median class size of 100 students (IQR 80-150) and median number of critical care faculty members of 2 (IQR 1-3). The majority of programs incorporated critical care education into the required didactic curriculum (77%). The topics covered in the greatest number of required didactic curricula were acute decompensated heart failure (88.7%) followed by hypertensive crises, stress ulcer prophylaxis and sepsis (all 83.9%). The majority of programs offered an elective in critical care (57%). The most common reasons for not offering an elective were insufficient faculty time and insufficient faculty expertise. The topics covered in the greatest number of elective didactic curricula were intensive care unit (ICU) sedation (67.4%) followed by ICU delirium, ICU pain management and sepsis (all 65.2%). The most common content

delivery strategies in the required and elective didactic curricula were lecture, problem-based and team-based learning. Simulations were used less frequently and to a similar extent in the required and elective curricula.

Conclusion: Some critical care education is incorporated into the curricula at many colleges and schools of pharmacy. However, colleges and schools of pharmacy that do teach critical care content do not frequently include all of the core foundational topics that are essential to the practice of critical care. Many colleges incorporate active learning strategies, including problem- and team-based learning, into the required and elective didactic curricula. The impact of these curricular choices on knowledge of and pursuit of positions that engage in the practice of critical care requires further evaluation.

1-022

Category: Critical Care

Title: Prolonged glimepiride induced-hypoglycemia associated with acute kidney injury

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Case Report: This case report exposes the potential risk of prolonged hypoglycemia associated with glimepiride in the setting of acute kidney injury. A 77 year old male presented to the emergency department with a chief complaint of shortness of breath, dizziness, and hypoglycemia. He has a past medical history significant for stage 3 chronic kidney disease, with a baseline serum creatinine of 1.3 mg/dL and type 2 diabetes mellitus for which he was taking glimepiride 2 mg daily. His initial blood glucose level upon admission to the emergency department was 50 mg/dL with a serum creatinine of 2.1 mg/dL. He was given a 25 gm dextrose bolus injection at that time. A re-check of his blood glucose indicated it had dropped to 35 mg/dL. He was then admitted to the cardiovascular intensive care unit for further evaluation and given an additional four 25 gm dextrose boluses throughout the next 12 hours. His blood glucose level responded minimally, ranging from 43-95 mg/dL over that time period. His serum creatinine on day two increased to 2.3 mg/dL. He received fifteen bolus injections of dextrose 25 gm on day two and was started on a 10% dextrose continuous infusion at 50 ml/hr. His blood glucose response was minimal and temporary, with blood glucose levels ranging from 30-86 mg/dL. Renal and Endocrinology teams were consulted as the patients hypoglycemia and acute kidney injury continued to worsen. He was placed on continuous renal replacement therapy on day three as he became oliguric. He received an additional twenty-four bolus injections of dextrose 25 gm and his 10% dextrose continuous infusion was changed to 20% dextrose at a rate of 25 ml/hr. His blood glucose levels continued to remain low, ranging from 35-169 mg/dL. His 20% dextrose continuous infusion rate on day four was increased to 50 ml/hr and he received an additional seven bolus injections of dextrose 25 gm. His blood glucose level ranged from 46-119 mg/dL. The patient started to show signs of improvement on day five. His blood glucose levels increased to a range of 94-180 mg/dL and by midday his continuous renal replacement therapy was discontinued along with his 20% dextrose continuous infusion. His blood glucose levels stabilized and he did not require any additional dextrose bolus injections. His renal function continued to improve and by day seven he had over 3 liters of urine output. His blood glucose levels remained within normal limits over the next five days without any treatment, ranging from 91-249 mg/dL. He was discharged after an eleven day hospitalization. His glimepiride was permanently discontinued and he was instructed to manage his type 2 diabetes mellitus with diet control only. Hypoglycemia is a common side effect of glimepiride, especially in elderly patients and in the presence of renal impairment. Glimepiride is metabolized via CYP2C9 isoenzyme to an active metabolite excreted in the urine. A literature search was completed and revealed a case report, a case series and a prospective analysis describing severe hypoglycemia for up to 64

hours with glimepiride. This case describes the longest documented duration of hypoglycemia associated with glimepiride treatment lasting approximately 108 hours. Acute renal dysfunction was the major precipitating factor leading to this adverse reaction. Healthcare providers should be cognizant of this potential with glimepiride and worsening renal function.

1-023

Category: Drug-Use Evaluation

Title: Reducing drug cost and waste of isoproterenol at an academic medical center using the Plan-Do-Study-Act cycle

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Purpose: Isoproterenol is a potent, nonselective beta-receptor agonist. Infusion at high doses has been shown to be pro-arrhythmic, and it serves an important role in inducing arrhythmias to identify areas for ablation in electrophysiology (EP). It is also used as a vasopressor in critical care units. In February 2015, one manufacturer became the exclusive supplier of isoproterenol, making it a single-source generic. As a result, its wholesale price increased sixfold. This project was designed to minimize the cost impact of a single-source generic price increase on a large health system through education, process change, and waste reduction.

Methods: A multidisciplinary team composed of several pharmacists, a nurse, physicians, and a physicians assistant participated in the Plan-Do-Study-Act method of process change to identify alternatives and areas of inefficiency and waste in the use of isoproterenol at an academic medical center. Discussions were facilitated by a pharmacy resident which centered around the current uses of the drug, possible alternatives in certain patient populations, processes for the ordering, preparation and provision of the drug product, and administration of the drug. Ultimately, the group decided to implement several interventions over the course of several months. Education involved informing providers about the price increase and possible cost-effective alternatives. Process changes included standardizing its preparation across the health system by utilizing drug storage, stability and sterility data to extend expiration dating on the standard compounded product, changing order sets to a standardized preparation, and scheduling EP cases to allow for batching of isoproterenol bags. Results of changes were assessed in real time, allowing for feedback and changes as necessary.

Results: In 2014, 201 orders were placed for isoproterenol infusions. Forty percent (n=75) were placed by the Pediatric EP lab, followed by 37% (n=81) in the Cardiovascular Intensive Care Unit; remaining orders were placed by providers in various other areas of the health system. These areas were the primary focus of educational interventions and process change. In the two months following provider education, orders were decreased to 23 orders total, with a projected 31% reduction annually. Inpatient purchases of isoproterenol in 2014 totaled 480 ampules. Three months after staff education and EP case schedule changes, as well as the process changes of batching, extended dating, and order set changes, total annualized purchases post-implementation are estimated to be 200 ampules, a 61% reduction year-over-year. These

interventions will result in approximately $352,000 of cost and waste avoidance annually. Feedback solicited from pharmacists, pharmacy technicians, nurses, and providers in the impacted areas was overwhelmingly positive.

Conclusion: Education and process changes implemented using the Plan-Do-Study-Act method successfully reduced usage and waste of isoproterenol at a large academic medical center. Staff education reduced overall utilization of the drug by 31%. Concentration, preparation, and storage modifications, order sets with a default to a standardized formulation of the drug, and scheduling changes allowed for batching and reduced waste of drug product. Overall, annual usage of the drug product is projected to decrease by 61%, preventing additional costs of approximately $352,000 annually for the health system. Positive response from stakeholders has allowed for continued success of the interventions.

1-024

Category: Drug-Use Evaluation

Title: Evaluation of intravenous ethacrynic acid utilization in an academic teaching hospital

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Purpose: There is a concern that patients with a hypersensitivity to sulfonamide antibiotics will react to sulfonamide non-antibiotics. A recent literature review did not find evidence for cross-reactivity, suggesting clinicians should consider not withholding sulfonamide non-antibiotics in patients with hypersensitivity to sulfonamide antibiotics. Ethacrynic acid is the only intravenous (IV) diuretic that does not contain a sulfonamide moiety. The objective of this medication use evaluation (MUE) was to assess utilization of IV ethacrynic acid and compliance with a hospital's Pharmacy & Therapeutics (P&T) committee decision to restrict ethacrynic acid use to patients with documented hypersensitivity to a loop or thiazide diuretic.

Methods: This Institutional Review Board approved MUE was a retrospective chart review of IV ethacrynic acid utilization at an academic medical center. Patients with active IV ethacrynic acid orders from July 1, 2014 to December 31, 2014 were included. Information collected comprised of medication given (IV and oral), medication dose, number of doses, documented allergy and medication name, order changes, and month of usage. Collected information was organized by pre-P&T decision (prior to September 21, 2014) and post-P&T decision (after September 21, 2014). Cost of therapy was also evaluated. Descriptive statistics were used to evaluate dosage data. Comparison between appropriateness in management pre-P&T and post-P&T (nominal data) was evaluated with the Fischers exact test.

Results: Twenty-six patient charts with active IV ethacrynic acid orders were reviewed. Pre-P&T, 18 patients (average 6.5 per month) received ethacrynic acid versus post-P&T when 4 of 8 patients (average 1.2 per month) received it. Overall, IV ethacrynic acid orders were either changed to oral ethacrynic acid (3 pre-P&T), changed to furosemide (2 pre-P&T, 5 post-P&T), or no change (13 pre-P&T, 3 post-P&T). Pre-P&T, 5 of 18 patients were appropriately managed. Of these, 3 required ethacrynic acid due to a furosemide or bumetanide allergy. The remaining 2 were appropriately switched to furosemide after several ethacrynic acid doses were administered. Post-P&T, 5 of 8 patients were appropriately managed. Of these, 4 never received doses from the order and were switched to furosemide by pharmacy. The remaining patient was appropriately switched to furosemide after one ethacrynic acid dose was administered. An increase in appropriate management was seen (27.8% pre-P&T, 62.5% post-P&T, p=0.09). Per patient, a median of 2 (range 1 to 20) IV doses pre-P&T and a median of 0.5 (range 0 to 13) IV doses post-P&T were given. The hospital could have saved approximately $180,000 (IV + oral) pre-P&T and $70,000 (IV) post-P&T if there was 100% compliance with the P&T decision.

Conclusion: Utilization of ethacrynic acid decreased from July through December, illustrating an increased compliance with the restriction of ethacrynic acid. There was an improvement in appropriate patient management between pre-P&T and post-P&T, though this was not statistically significant, and there is still room for improvement. Limitations of this study include retrospective nature, sample size, and allergy documentation. The results have been shared with P&T. This MUE illustrates the need for hospitals to continually review literature pertaining to their formulary, including older drugs like ethacrynic acid. This allows for potential cost-savings and appropriate availability of efficacious and safe medications for patients.

1-025

Category: Drug-Use Evaluation

Title: Proton pump inhibitor utilization in hospitalized patients

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Purpose: Proton pump inhibitors (PPIs) suppress the final step of gastric acid secretion by irreversibly binding to and inhibiting the parietal cell proton pump. PPIs are used for a variety of conditions including gastroesophageal reflux disease (GERD) and peptic ulcer disease (PUD), as well as for stress ulcer prophylaxis (SUP). Prior studies have suggested that there is significant overuse of PPIs in hospitalized patients. The purpose of this study was to characterize PPI prescribing patterns within the Jefferson Health System intensive care units (ICUs), identify inappropriate continuation of therapy upon discharge, and assess adverse outcomes from therapy.

Methods: The institutional review board approved this retrospective drug use evaluation of PPI use in hospitalized patients. Fifty adult patients admitted in an ICU bed at Center City, Jefferson Hospital for Neuroscience, and Methodist campuses in November 2014 were included in the analysis. Patients were excluded if the cause for admission was acute gastrointestinal bleeding. Variables assessed included demographic characteristics, risk factors for development of stress ulcers, as well as dosing, indication, duration, and adverse effects associated with PPI therapy.

Results: The mean age was 61.4 years and 48 percent of patients were female. Patients admitted to medical, surgical, neurology, and cardiovascular ICUs were represented, with the highest proportion of patients followed by a surgery admitting service. Twenty-seven patients (54 percent) had been prescribed a PPI as an outpatient prior to admission. Trauma, surgery, central nervous system injury and Symptomatic GERD were the most frequently selected PPI indications. Approximately half of the patients had more than one PPI indication selected over the course of therapy. The majority of patients (88 percent) were prescribed a PPI throughout the entire duration of admission, with 11 patients being discharged on a PPI as a new medication. Four patients developed Clostridium difficile diarrhea and 17 patients were evaluated for pneumonia during their admission.

Conclusion: Retrospective analysis of appropriate PPI use for SUP was difficult as this could have represented continuation of outpatient therapy. Targeting outpatient PPI prescribing patterns may have a greater impact in managing overuse in the general population. However, medication use guidelines can be developed to facilitate appropriate PPI prescribing for SUP in the inpatient setting. Based on the results of this analysis, an acid-suppression medication reconciliation form was recommended to reinforce appropriate SUP during transitions of care.

1-026

Category: Drug-Use Evaluation

Title: Evaluation of the use of omalizumab in a community hospital

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Purpose: The high cost of omalizumab treatments motivated the Spanish Health Agency to change its dispensation from chemists to hospital pharmacy departments in order to monitor strictly all prescriptions. The purpose of this study was to evaluate the omalizumab prescriptions due to the recent change of the drug-dispensing system and to evaluate the computerized medical record (CMR) as a source of information.

Methods: A descriptive cross-sectional study of all patients treated with omalizumab in a community hospital. The list of patients was given by the respiratory department. Patients CMRs were reviewed and the data collected were: demographics data, diagnosis, weight, serum IgE levels, forced expiratory volume at first second (FEV-1), dosage, concomitant use of oral glucocorticoids (GC), inhaled GCs and/or inhaled long-acting beta-2-agonist.

Results: 24 patients were included: 6 men and 18 women. The average weight and age were 72 kg and 43 years, respectively. We could only check the omalizumab dosage in 12 patients because of lack of information. Only 6 of 12 patients had indication and dosage according to the drug technical specifications. The FEV1 data appeared in the CMR of 15 patients, with a value less than 80% (reduced lung function) in 8 (53.3%). 20 patients were treated with inhaled GC and beta-2-agonists. Only one patient was treated with oral GC.

Conclusion: The majority of the omalizumab prescriptions are according to drug label requirements but data from the CMR are scarce. For this reason, it would be necessary to agree a report model in the computer application with the Respiratory Department for new treatments and reviews.

1-027

Category: Emergency Medicine / Emergency Room

Title: Drug-induced hyponatremia in adults who attend the emergency department

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Purpose: Hyponatremia is defined as a serum sodium level ([Na]p) of less than 135 mmol/L. It is considered moderate when the [Nap] is below 125 mmol/L and severe when it is below 115 mmol/L. Many illnesses, such as congestive heart failure, liver failure or renal failure may be associated with hyponatremia. Symptoms range from nausea and malaise, with mild reduction in the [Nap], to decreased level of consciousness, headache, and (if severe) seizures and coma. The purpose of this study was to evaluate hyponatremia events that were attended in the Emergency Department (ED) and possible influence of drugs in its source.

Methods: This retrospective observational study included all adults with hyponatremia ([Nap] less than 135 mmol/L) who attended the ED of our University Hospital from 1 January and 31 December 2014. A team composed of physicians and pharmacists collected the following information from medical records: age, sex, personal medical and pharmacologic history, polypharmacy (more than 4 medications), type of hyponatremia (classified according to volume status: hypovolemic, euvolemic or hypervolemic hyponatremia), reason why attend the ED, urine sodium level, destination from ED, length of stay in hospital and number of registered hyponatremias prior to hospitalization and a year later after the discharge.

Results: A total of 371 adults attend the ED due to hyponatremia events (3% were severe; 18.6%, moderate; 78,4%, mild). The mean age of was 74 years and most of patients were women. The most common causes for attendance to the ED were dyspnea (27.2%), abdominal pain (18%) and hematuria (18%). Other causes were headache, dizziness, slack and coma. The most common pathology was cardiovascular (43.3%), followed by endocrine (23.3%) and respiratory (10%). 18.2% patients were hypervolemic, 18.2% patients were hypovolemic and the others were euvolemic. There was polypharmacy in 81.8% of patients and 90.9% patients took diuretics, followed by angiotensin-converting enzyme inhibitors and angiotensin II receptor blockers. 54% events were diuretic-induced hyponatremias. Patients were hospitalized in an Observation Area and the mean length of these stays in ED was 30 hours. The most frequent patients destination was hospitalization and the mean length of stays was 12 days. The patient who had more previous hyponatremia episodes (10 episodes) and suffered from 5 episodes after discharge took the highest number of drugs.

Conclusion: Hyponatremia is an important disorder which can be unnoticed and cause attendance to the ED and frequently repetitive episodes. The most common hyponatremia cause is a side effect of medications (especially diuretics) and most of these patients have polypharmacy. For this reason, pharmacist intervention through the pharmacotherapy-monitoring of the polymedicated patients can be key in preventing occurrence of hyponatremia episodes.

1-028

Category: Emergency Medicine / Emergency Room

Title: Evaluation of Vancomycin and Piperacillin/tazobactam Auto-Verification in the Emergency Department

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Purpose: Evaluate auto-verified vancomycin and piperacillin/tazobactam and allergy documentation in the Emergency Department.

Methods: Single center, IRB approved, retrospective chart review performed between January March 2014. Demographic, allergy, admission reason, and treatment indications were collected through the electronic medical record.

Results: One hundred patients were analyzed, of which 89 met inclusion criteria. Seventy-six patients received auto-verified vancomycin and 68 patients received auto-verified piperacillin/tazobactam. Of the 76 patients who received auto-verified vancomycin and piperacillin/tazobactam, 61% and 11% were dosed incorrectly, respectively. Allergy information was obtained on all 89 patients. Forty-seven patients had medication allergies documented, of which 20 had reactions defined. Data was analyzed through use of descriptive statistics.

Conclusion: Based on current hospital and evidence-based medicine guidelines, vancomycin and piperacillin/tazobactam are being dosed inadequately in the Emergency Department. Also, medication allergy documentation is incomplete on the majority of patients, limiting medication options, which hinders our ability to provide high quality patient care.

1-030

Category: General Clinical Practice

Title: Pharmacist-Driven Argatroban Dosing Policy in an Acute Care Setting

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Purpose: A need for an argatroban protocol to provide standardized treatment was recognized by the Clinical Pharmacy Specialist in Internal Medicine to increase patient safety and to assist both providers and nursing staff with guidance for appropriate usage, dosing, and administration; as argatroban is a high-risk medication.

Methods: Retrospective chart review looking at all argatroban orders processed from January 1, 2010 through November 20, 2014. The 2 comparator groups evaluated were those orders dispensed before and after the inception of the pharmacist-driven medical center policy in January of 2013. The charts were reviewed for presence of thrombocytopenia, a positive heparin antibody assay, and/or the initiation of argatroban by the Hematology/Oncology service to assess appropriate usage.

Results: Before the creation of the pharmacist-driven policy, a quarter of all argatroban usage was inappropriate. After initiation and adoption of the medical center policy, all argatroban orders had a documented appropriate indication and were then closely monitored and dosed by the clinical pharmacist.

Conclusion: By involving a clinical pharmacy specialist to manage argatroban infusions within the facility, it led to the assurance of appropriate medication utilization, an increase in cost-savings for the facility, and decreased the volume of prescribed argatroban.

1-031

Category: General Clinical Practice

Title: National integration of clinical pharmacists into team-based care: lessons learned

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Purpose: Clinical pharmacy practice models are in constant transition to meet the needs of a healthcare system facing an aging population, increasing complexity of medication regimens, and a shortage of physicians. With this in mind, efforts were made to standardize and expand the role of the clinical pharmacist in team-based models of care throughout VA.

Methods: The VA Pharmacy Benefits Management Services (PBM), Clinical Pharmacy Practice Office (CPPO) employed a multi-dimensional approach consisting of education and training, policy and guidance deployment, data collection systems development, and granular data reporting and analysis to VA facilities to support and expand clinical pharmacy practice. Clinical pharmacy penetration metrics were developed to quantify the number of clinical pharmacists with an advanced scope of practice (SOP), areas covered by their SOP, direct patient care encounters performed, and pharmacist integration on Patient Aligned Care Teams (PACT). Guidance documents and education were developed to support strong practices and consistency in pharmacist SOP, how to allocate PACT pharmacists as members of the care team, and Pharmacy PACT business rules. In support of promoting expansion and standardization of the role as mid-level providers with a SOP, CPPO developed and conducted face-to-face and virtual Clinical Pharmacy Boot Camp Programs in 2011 and 2013 to train pharmacists in disease state pharmacotherapy management. The programs prepared participants to transition from disease state or medication-specific SOPs to global or practice area based SOPs. Additionally, CPPO focused its efforts on significantly expanding clinical pharmacy presence in targeted gap areas including Hepatitis C, Mental Health and Antimicrobial Stewardship.

Results: The VA Healthcare System has over 7,700 clinical pharmacists practicing at 150 medical centers across the nation caring for over 8.9 million Veterans. Over 3,100 (41 percent) of these clinical pharmacists practice in an advanced practice role with a scope of practice which includes medication prescriptive authority. The number of pharmacists with a SOP in VA increased 63 percent from FY2011 to FY2015 with an increase in global SOP by over 5 fold. During the same period, clinical pharmacy visits increased by 96 percent to an estimated 4.8 million visits annually in 2015. Pharmacist full-time equivalent employees (FTEE) allocated to PACT teams was first measured in 2013. While still not at staffing levels currently recommended in VA policy, pharmacist FTEE allocation to PACT has increased by 82 FTEE nationwide between October 2013 and June 2015. Growth in targeted areas has been tremendous

with an increase in Hepatitis C of 79 percent, Mental Health of 179 percent, and Infectious disease/Antimicrobial Stewardship of 90 percent.

Conclusion: By implementing a broad based, yet focused, strategic plan PBM CPPO has been successful in developing and expanding the role of the clinical pharmacist in team-based models of care in VA. This expansion has been particularly effective in targeted growth areas of Hepatitis C, Mental Health and Antimicrobial Stewardship.

1-033

Category: Geriatrics

Title: Identification of risk factors for delirium in elderly patients at a community-based medical center

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Purpose: Delirium is a prevalent condition affecting 10-40% of hospitalized geriatric patients, and is associated with an increased risk of morbidity and mortality including postoperative complications, functional decline, and increased length of stay. Several risk factors for the development of delirium have been identified; however, specific risk factors may vary between facilities. Thus, identification of institution-specific risk factors may allow for focused targeted interventions to reduce delirium. The purpose of this analysis is to identify risk factors for the development of delirium at a 500-bed community-based medical center by mining data in a Pharmacy Information System.

Methods: A retrospective case-controlled study was conducted on all hospitalized patients 70 years of age or older admitted in 2014 at a community-based medical center. Patients were excluded if they were admitted to the intensive care unit at any point during hospitalization, had a positive confusion assessment method (CAM) score within 24 hours of admission, were admitted for less than 24 hours, or were admitted to a psychiatry unit. Delirium was defined as a positive CAM score as assessed on each nursing shift in all patients 70 years of age or older. A logistic regression was performed to identify risk factors for delirium during hospitalization. All patients identified were randomly separated into a training set (80%), and a test set (20%) to evaluate the predictive performance of the logistic regression. All risk factors were collected using SQL queries run against the Pharmacy Information System database. Factors collected include the presence of orders for corticosteroids, trazodone, benzodiazepines, opioid analgesics, diphenhydramine, number of overnight room transfers, and length of hospital stay.

Results: There were 5,897 patients selected for inclusion accounting for 8,194 unique admissions. Of those, 789 admissions met exclusion criteria and were not included in the analysis. The training set contained 80% of the remaining 7,405 admissions (n=5924) and the test set contained 20% (n=1,481). The mean age of the patients was 82 years of age, and the most common primary ICD-9 diagnoses were septicemia, urinary tract infection, and pneumonia. A logistic regression fit to the training set found that the following variables significantly contributed to the odds of developing delirium: the presence of orders for benzodiazepines (OR 1.71) or trazodone (OR 5.03), as well as length of stay (OR 1.07). A protective effect of opioid analgesics was found for the development of delirium (OR 0.62). The following variables did not contribute to delirium: the presence of orders for corticosteroids or diphenhydramine, and

overnight room transfers. When evaluated on the test set, the logistic regression model categorized patients with 92.1% accuracy; sensitivity was 99.9%, but specificity was only 3.4%.

Conclusion: Length of stay and presence of orders for benzodiazepines, trazodone, and opioid analgesics were significantly correlated with the development of delirium. The analysis found, however, that absence of these factors was not associated with reduced incidence of delirium. This study was limited by the lack of a temporal relationship between medication orders and the development of delirium. Further analysis of the effects of combined factors and cumulative dosage is warranted.

1-034

Category: I.V. Therapy / Infusion Devices

Title: Stability of isoniazid injection in intravenous solutions

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Purpose: Isoniazid, a first-line medication in prevention and treatment of tuberculosis, is approved for intramuscular administration in the United States. While isoniazid injection has been administered intravenously to patients unable to take oral isoniazid, there is limited information on the stability of isoniazid in intravenous fluids. The physical compatibility and chemical stability of isoniazid injection in 0.9 percent sodium chloride injection and 5 percent dextrose injection was assessed.

Methods: Triplicate solutions of isoniazid (0.5 mg/mL and 6 mg/mL) in 0.9 percent sodium chloride injection or 5 percent dextrose injection were prepared in ethylene and propylene copolymer intravenous containers and stored under light protection at room temperature (20 to 25 degree C) or under refrigeration (2 to 8 degree C). Samples were taken from each solution at 0, 8, 12, 18, 24, 30, 48 and/or 72 hours and were analyzed by a stability-indicating high-performance liquid chromatography method from USP monograph USP37/NF32. The pH and osmolality of the solutions were measured and the solutions were visually inspected at these same time points. Stability was defined as retention of not less than 90 percent of the initial isoniazid concentration.

Results: All isoniazid 0.5 mg/mL and 6 mg/mL solutions in 0.9 percent sodium chloride injection retained over 90 percent of the initial isoniazid concentration up to 72 hours. However, isoniazid concentrations decreased significantly in the 5 percent dextrose solutions. Rates of isoniazid degradation were faster at a 0.5 mg/mL concentration and at room temperature. Isoniazid 0.5 mg/mL solutions in 5 percent dextrose revealed a decrease to less than 90 percent of the initial concentration in 8 hours and 30 hours at room temperature and under refrigeration, respectively. Isoniazid 6 mg/mL solutions in 5 percent dextrose were stable up to 24 hours at room temperature and 48 hours under refrigeration. The pH and osmolality of the solutions varied by concentration, but did not change significantly over 72 hours. No particles were detected in any solution by visual inspection.

Conclusion: Isoniazid 0.5 mg/mL and 6 mg/mL in 0.9 percent sodium chloride injection were stable up to 72 hours when stored at room temperature or under refrigeration. Isoniazid injection

was less stable in 5 percent dextrose injection, especially at a 0.5 mg/ml concentration and at room temperature.

1-035

Category: Infectious Diseases

Title: From Pilot to Practice: Implementation of a Multi-hospital Antimicrobial Stewardship Program

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Purpose: The interest and need for developing antimicrobial stewardship programs (ASP) across the country is surging. There is a high likelihood of it becoming a condition of participation for reimbursement with the Centers for Medicare & Medicaid Services. As a result, many health systems will need to determine how to expand their reach with current or additional resources. In 2015 we received approval to expand our single entity ASP pilot program to all four metropolitan hospitals in our health system. This expanded our patient reach from 159 beds to 1,020 beds. The intent of this poster is to provide an overview of some of our successes and barriers to implementing a multi-hospital stewardship program.

Methods: Starting in 2010 at our Saint Lukes North campus, our unit-based pharmacists and an infectious disease (ID) physician began meeting three times a week to review patients with active cultures in the last 7 days, among other proactive stewardship activities. Additionally, the patients antimicrobials and indications for use were cross examined to determine appropriateness of therapy. Necessary changes were communicated to the attending physician by the pharmacist or ID physician. Due to the success of the program and our health systems recognition of the need for antimicrobial stewardship services, the program was expanded to our four metropolitan hospitals. Under the newly developed ASP umbrella is a half-time ID physician and a full-time ID pharmacist and data analyst. In 2014 we went live with EPIC as our electronic health record (EHR). This provided the opportunity to assess more patients from a centralized ASP position. As a result, we collaborated with our information technology (IT) department to devise a more expansive reporting and analytic system for assessing high-level ID and ASP information.

Results: When covering a large patient population with limited resources, optimizing workflow and prioritizing activities becomes essential. An integrated EHR makes stewardship initiatives more realistic for such a large population. Examples of efficiencies built in our program include: case escalation model where unit-based pharmacists request the ASP to review difficult cases, facilitation of therapy with real-time blood culture result reporting, de-escalation of prolonged broad spectrum therapy, identification of multi-drug resistant bacteria and other targeted microbes, broad reach from single ASP position. There are also a number of barriers to implementing a multi-hospital ASP. Some of the opportunities we identified include: increasing proactive education to all staff levels prior to go-live, planning many months in advance with

your IT team to allow creation of specific reports, identifying limitations in real-time reporting capabilities, and identifying broadly accepted measurements of program success that are easily translated to system leadership.

Conclusion: There are many factors to consider when expanding a program from a single site to multiple hospitals. Immediately integrating key players and open communication is critical to become maximally effective.

1-036

Category: Infectious Diseases

Title: Artesunate intravenous in a patient refractory to artemether/lumefantrin therapy for treatment of malaria caused by plasmodium falciparium:

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Case Report: Malaria caused by plasmodium falciparum is a common infection frequently diagnosed in persons traveling in or indigenous to West Africa. This disease can present an even larger complication given the recent Ebola outbreak due to both disease states presenting with similar symptoms starting with a high fever. Artemether/lumefantrine is recommended by the Centers for Disease Control and Prevention as first line therapy for uncomplicated malaria caused by plasmodium falciparum. Artesunate injection, currently under Investigational New Drug status in the United States is an alternate therapy that can be given by intravenous administration in patients unable to take oral medication or are not responsive to orally administered artemether/lumefantrine. We are presenting a case of cerebral malaria that was unresponsive to artemether/lumefantrine and was treated in the non-ebola patient ward of an Ebola Treatment Unit due to disease severity upon admission. The patient was a 52 year old male who presented with an unexplainable fever greater than 101 degrees fahrenheit where he was found to have a positive malaria test result but tested negative for ebola. Upon admission to the non-ebola ward of the Ebola Treatment Unit he was started on artemether/lumefantrin orally per protocol. It is recommended patients eat high fat foods when ingesting this medication to enhance absorption of the drug. The patient experienced nausea and vomiting following admission and was unable to take in food but was able to still swallow and tolerate oral medication. His fever persisted and his symptoms worsened as he began to experience a temporal headache that was treated with ibuprofen, acetaminophen and acetaminophen/oxycodone unsuccessfully. After two days of artemether/lumefantrin therapy without improvement he was changed to intravenous artesunate due to suspected absorption problems surrounding oral artemether/lumefantrin, his inability to hold down high fat food that is recommended to be eaten concurrently with medication administration and presence or progression of possible cerebral malaria. Within twenty four hours of initiating artesunate his electrolytes began to normalize, his headache began to decrease and he became afebrile. He experienced no adverse effects or complaints associated with artesunate administration. He completed a full course of artesunate, remained asymptomatic and was discharged. Artesunate was received from the Liberian Ministry of Health to be used in the treatment of a Liberian National, although it is still considered an Investigational New Drug in the United States, in other countries the World Health Organization recommends its use for the treatment of malaria.

Treatment in this case did not occur in the United States making the drug available for use with getting approval for administration of an Investigation New Drug.

1-037

Category: Infectious Diseases

Title: A review of ceftaroline fosamil utilization at a large community teaching hospital.

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Purpose: Ceftaroline fosamil was approved in 2010 for the treatment of community acquired bacterial pneumonia (CABP) and acute bacterial skin and skin structure infections (ABSSIs). It has activity against Staphylococcus aureus, including methicillin resistant isolates. However, it is only labeled for treating methicillin-resistant Staphylococcus aureus (MRSA) skin and skin structure infections. Due to its bactericidal activity there is increased interest in using it for off-label indications especially when compared to other agents currently being used for MRSA infections.. In an effort to identify any additional opportunities for use, we reviewed ceftaroline at our institution looking for additional roles in therapy.

Methods: All patients that received ceftaroline at our institution from June 1st, 2013 March 1st 2015 were identified through a mix of concurrent review and retrospective data provided by our EPIC computer system. Data reviewed included dosing, average duration of therapy, adverse effects, indication, therapy rationale, and outcomes if therapy was continued after discharge. Specifically, we were looking for readmission for a worsening indication or admission for a medication-related adverse event. The data was entered into a Microsoft Excel spreadsheet for analysis, and purchasing data was also collected to review for any potential cost-savings.

Results: One hundred and two patients received ceftaroline over the data collection period. Average patient age was 66 years (31-97), average length of stay of 10 days (0-37), and patients received an average of 3 days of therapy (0-22 days). The most frequent indication for use was skin and soft tissue infections (48%), lung infection (19%), and joint/osteomyelitis infections (12%). The rationale for use varied, with poor renal function being the most commonly observed reason for use at 48%, followed by allergies to vancomycin at 18% and a larger patient size at 11%. The overall adverse event rate observed for patients starting and stopping therapy while admitted was 1.2% with one patient reporting a mild leucopenia. An additional 20 patients received longer courses of therapy that were continued after discharge. None of these patients were readmitted for treatment failure; however 4 patients did report adverse reactions, including two with rashes, one with neutropenia and one with thrombocytopenia. All of the reactions resolved with discontinuation of therapy, and of note, four out of the five patients were receiving a higher off-label dosing due to severity of their infection.

Conclusion: Our review demonstrated off-label utilization of ceftaroline in half of our patients, and renal function was an important rationale for selection. We did not identify any treatment failures, however we did observe several adverse reactions. The overall adverse event was 5%, however, in patients that were treated for more than 10 days that rate rose to 20%. Additionally, we found that these patients were receiving a higher off-label dosing for more severe infections.

Our data suggests that ceftaroline may be a possible alternative for treating MRSA, especially when concerned with nephrotoxicity that may occur with conventional therapy.

1-038

Category: Investigational Drugs

Title: Initial experience with idarucizumab in dabigatran-treated patients requiring emergency surgery or intervention: interim results from the RE-VERSE AD study

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Purpose: Dabigatran, an oral thrombin inhibitor, is widely used for stroke prevention in nonvalvular atrial fibrillation. Although its half-life of 12-17 hours in patients with normal renal function allows for timely interruption of dabigatran prior to elective surgery, rapid reversal is desirable to restore hemostasis in those requiring urgent surgery or intervention. Idarucizumab, a humanized Fab fragment directed against dabigatran, has demonstrated immediate, complete, and sustained reversal of the anticoagulant effects of dabigatran in healthy volunteers, and attenuated bleeding in animal models. Therefore, idarucizumab has the potential to improve management of dabigatran-treated patients who require anticoagulation reversal prior to urgent surgery.

Methods: The phase III RE-VERSE-AD study is the first clinical trial to test the effect of idarucizumab in patients with life threatening or uncontrolled bleeding or in those requiring urgent surgery. In this ongoing study, dabigatran-treated patients requiring emergency surgery or intervention are given intravenous idarucizumab as two 2.5 g bolus infusions administered no more than 15 min apart. Patients gave informed written consent. The primary endpoint is the maximum reversal of the anticoagulant effect of dabigatran in the first 4 hours, based on central laboratory determination of the dilute thrombin time or ecarin clotting time. A secondary endpoint for surgical/procedural patients is the clinical classification of peri-procedural bleeding as normal hemostasis during the procedure; mildly abnormal intraprocedural hemostasis as judged by quantity or quality of blood loss (e.g. slight oozing); moderately abnormal; (e.g. controllable bleeding); or severely abnormal (e.g. severe refractory hemorrhage).

Results: Of the first 39 patients given idarucizumab prior to emergency surgery, 36 had surgery, 1 was cancelled and 2 were too unstable for surgery. In 36 patients, the median maximum reversal of dabigatran anticoagulant effect was 100% (95% CI 100-100). Peri-procedural bleeding was assessed as normal in 33 (91.7%), mildly abnormal in 2, and moderately abnormal in 1 patient. Cases included 14 abdominal procedures and 8 emergent orthopedic procedures, 4 catheter placements, and 10 other procedures (n <4). The effect of idarucizumab on coagulation parameters and the clinical outcomes of the patients will be presented.

Conclusion: Idarucizumab rapidly reverses the anticoagulant effects of dabigatran. Idarucizumab administration to dabigatran-treated patients requiring urgent surgery may improve hemostasis at the interventional site.

1-040

Category: Leadership

Title: Creation of a Bedside Discharge Medication Delivery Service

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Purpose: The Affordable Care Act of 2010 linked hospital reimbursements to quality metrics. Because of this, new processes and services have been generated. One such service, the bedside delivery of discharge medications, aims to reduce readmissions and increase patient satisfaction. The purpose of this project is to design and implement a pilot discharge medication delivery service at UAB Hospital.

Methods: To begin this process, a literature review was conducted on bedside delivery and its potential effects. The next step in the development of this service was a review of national vendors and retail chains offering bedside delivery services. From this, the initial workflow and projected capture rate were generated. The final step in this process involved reviewing similar services at other academic medical centers. This was accomplished by two University HealthSystem Consortium (UHC) surveys. These surveys revealed the prevalence of similar services, the potential effect of the services, staffing requirements, and obstacles to implementation faced by the responders.

Results: Utilizing the information obtained during the research phase, the core components of personnel, technology, marketing and finances were determined. The service was designed to be technician-driven, with each technician expected to be responsible for 50-75 beds. Mobile devices were purchased and equipped with software that allows for point-of-sale transaction processing at the bedside. The software was integrated into the retail pharmacy's computer system to allow for transaction data to be stored. For marketing, posters and flyers were created to advertise the service to both patients and physicians. The implementation of the service was also announced through organization-wide email. A pilot program was initiated in May 2015, with implementation occurring on a unit-by-unit basis.

Conclusion: The creation of a bedside discharge medication delivery service at UAB Hospital has the potential to ensure continuity of the high level of care provided while inpatient to the patient's home. This project successfully designed and implemented a pilot discharge medication delivery service. This pilot program will allow the workflow process to be streamlined before implementation throughout the entire campus.

1-042

Category: Oncology

Title: Association between zoledronic acid-related kidney injury and concomitant administration of hydrophilic rather than lipophilic statins in cancer patients

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Purpose: The frequency of treatment option for bone metastases from cancer has been increased. Zoledronic acid, a mevalonate pathway inhibitor, is widely used for the treatment of metastatic bone disease from cancer. Kidney injury is a serious side effect of zoledronic acid treatment. Since statins also inhibit 3-hydroxy-3-methylglutaryl-coenzyme A (HMG-CoA) reductase, the key enzyme of the mevalonate pathway, the frequency and severity of zoledronic acid-related kidney injury may worsen following the concomitant administration of statins. In the present study, we examined the influence of concomitant administration of statins on the kidney injury in cancer patients receiving zoledoronic acid.

Methods: The protocol of this study was approved by the Ethics Committee of Kyushu University Graduate School and Faculty of Medicine. The medical records of adult cancer patients treated with zoledronic acid between January 2009 and December 2014 were retrospectively reviewed. The patients were excluded if they received zoledronic acid for the treatment of malignant hypercalcemia, could not be examined the serum creatinine (Scr) values for at least 3 weeks, and had a documented episode of acute kidney injury within 1 month prior to the date of the first zoledronic acid infusion. Patients with decreased creatinine clearance (Ccr) values (Ccr 60 mL/min) were also excluded if they did not receive a manufacture-recommended dose of zoledronic acid. Similar to the previous studies (D. Agujar Bujanda, et al. Ann Oncol. 18: 556-60, 2007), kidney injury was defined as an absolute increase in Scr 0.5 mg/dL from baseline (Scr < 1.4 mg/dL) or 1.0 mg/dL (if the baseline Scr 1.4 mg/dL). To identify the factors associated with kidney injury, univariate and multivariate logistic regression analyses were performed. P values < 0.05 were considered statistically significant.

Results: Of 485 patients who received at least one infusion of zoledronic acid during the study period, 350 patients met the inclusion criteria. The median number of zoledronic acid treatment was 5 (range: 1-60). Thirty-two (9%) patients developed kidney injury. The incidences of kidney injury in patients who received concomitant hydrophilic statins (pravastatin or rosuvastatin), lipophilic statins or did not receive any statins were 7/18 (39%), 4/26 (15%) and 21/306 (7%), respectively. Multivariate logistic regression analysis revealed that concomitant administration of

hydrophilic statins [odds ratio [OR] = 8.01; 95% CI = 2.58C24.04; P < 0.01], received zoledronic acid administration 6 times (OR = 3.66; 95% CI = 1.64C8.94; P < 0.01) and comorbidity of diabetes mellitus (OR = 2.79; 95% CI = 1.09 C 6.70; P < 0.01) were significantly associated with kidney injury.

Conclusion: Concomitant administration of hydrophilic statins, zoledronic acid administration 6 times and comorbidity of diabetes mellitus were revealed to be significant risk factors for zoledronic acid-related kidney injury. Therefore, patients with these risk factors should be monitored carefully. The results of this study suggested that zoledronic acid-related kidney injury worsens after concomitant use of hydrophilic statins, which are preferentially eliminated by the kidneys. Replacing hydrophilic statins by lipophilic statins may be a potential alternative to avoid zoledronic acid-related kidney injury. These results warrant further prospective research.

1-043

Category: Oncology

Title: Oxaliplatin desensitization protocol for a differential diagnosis of a hypersensivity reaction

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Purpose: Oxaliplatin is used for treatment of colorectal cancer, typically along with folinic acid and 5-fluorouracil. It is an effective drug but it can produce side-effects such us an allergic reaction. The purpose of this study was to evaluate the utility of an oxaliplatin desensitization protocol to confirm a hypersensivity reaction of this drug.

Methods: This was a retrospective observational study which included a 36-year-old woman who suffered from a chemotherapy-refractory metastasic colorectal cancer since 2012. The patient was operated and after that she was prescribed chemotherapy with previous premedication: 8 cycles of XELOX (capecitabine plus oxaliplatin). She only received one dose of oxaliplatin because she experienced malaise during the infusion and dyspnea, dysphagia and difficulty in breathing at the end of it (she needed oxygen therapy). She was only treated with capecitabine. One year later she was treated with bevacizumab-FOLFIRI (irinitecan/folinic acid/fluorouracil) regimen which was well tolerated. Because of a relapsed ovarian cancer, she was prescribed chemotherapy with fluorouracil, folinic acid, oxaliplatin and irinotecan (FOLFOXIRI) plus bevacizumab. A team composed of an oncologist, an allergist and a pharmacist carried out an oxaliplatin desensitization protocol.

Results: Skin tests were performed with oxaliplatin: skin prick test (5 mg/ml) and intradermal injections serial (0.001, 0.01, 0.1, 1 and 5 mg/ml). The allergy-proof reading was negative immediately and 24 hours later. Total oxaliplatin dose (155 mg) was administered the next day: 1/100 and 1/10 of the dose and finally the remainder. Premedication was dexamethasone, dexchlorpheniramine and and ondansetron. Rest of chemotherapy regimen was given the following day and omeprazol, fluorouracilo and deflazacort at night. The patient visited the emergency department 36 hours after oxaliplatin infusion because a pruritic macular reaction in both arms. The patient was recommended not to take oral glucocorticoids because the allergic reaction could be associated with them. 5 complete cycles were administered with no more adverse events.

Conclusion: Oxaliplatin desensitization protocol carried out by a multidisciplinary team (oncologists, allergists and pharmacists) was useful for the differential diagnosis of a hypersensivity reaction.

1-044

Category: Operating Room Pharmacy

Title: Pharmacy directed cost savings initiative following a significant price increase in sodium nitroprusside

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Purpose: Lack of competition on the generic drug market has led to price increases for certain generic drug products including sodium nitroprusside, whose cost increased from approximately $40 per vial to $200 per vial in 2014. Sodium nitroprusside, an intravenous vasodilator, was routinely used in cardiac surgery cases prior to price increase with projected annual spending of $1 million dollars at our institution after the increase. Pharmacy implemented a cost savings initiative substituting nicardipine or clevidipine for sodium nitroprusside as agents of choice in cardiac surgery. This analysis is aimed at determining the cost savings associated with this initiative.

Methods: Following news of the significant projected increase in nitroprusside spend, pharmacy specialists worked with surgery, anesthesia, and perfusion to discuss alternative products for hypertension control and afterload reduction during cardiac surgery procedures. Based on these discussions, nicardipine and clevidipine were determined to be suitable alternatives and became the preferred agents, with nitroprusside reserved for refractory hypertension. This practice change started in April 2014. The financial impact of the intervention was assessed by analyzing sodium nitroprusside, clevidipine and nicardipine purchase data before (April 2013-March 2014) and after (April 2014-March 2015) intervention. Sodium nitroprusside savings were calculated as the difference between sodium nitroprusside spend pre- and post- intervention. The sodium nitroprusside savings were adjusted to account for increased clevidipine and nicardipine spend. This adjusted value was considered the overall intervention savings. Additionally, volume estimates for number of cardiac surgery cases were obtained for a volume-adjusted comparison of nitroprusside use before and after the intervention.

Results: The intervention resulted in a 74% reduction in annual nitroprusside spend ($199,161 pre-intervention versus $51,983 post-intervention). This decrease was seen in both total drug expenditure as well as number of vials used per case. A portion of post-intervention savings were also offset by an additional nitroprusside cost increase in February 2015. The number of vials purchased during the post-intervention period was reduced. There were 2,273 vials purchased for 819 cardiac surgery cases in the pre-intervention period (2.78 vials per case), and 191 vials purchased for 742 cardiac surgery cases in the post-intervention period (0.26 vials per case). Interestingly, there was also a reduction in clevidipine ($453,590 pre- versus $248,395 post-

intervention) and nicardipine ($276,314 pre- versus $174,331 post-intervention) spending after the intervention. This change is likely related to the use of premix clevidipine and nicardipine versus admixed nitroprusside, and a corresponding reduction in waste. Prescribers reported no significant issues with the use of nicardipine and clevidipine during the post-intervention period.

Conclusion: Working with other disciplines, a pharmacy initiated intervention to decrease routine use of nitroprusside reduced drug costs without any prescriber-observed issues with care. In addition, this switch to premix products for operative patients resulted in additional savings related to reduction in product waste. Pharmacy departments should be vigilant in detecting substantive drug price increases, especially for older generic products. Where possible, opportunities for changing to lower cost alternatives should be implemented.

1-045

Category: Pain Management

Title: Efficacy of Exparel in Revision and Total Knee Replacements

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Purpose: Evaluate Liposomal Bupivacaine (Exparel) used for pain management in primary TKR and Revision TKR (RTKR.

Methods: This retrospective study of 599 consecutive patients included Exparel periarticular injection in 270 patients (259 TKR, 11 RTKR) compared to 329 patients (307 TKR, 22 RTKR) treated by the same pain management protocol without Exparel. Length of stay (LOS), time to first opioid administration, opioid administration, HCAHPS pain survey, and direct cost of care were evaluated.

Results: Patients receiving Exparel had no statistically significant difference in LOS (TKR 3.4 days, p=0.35 RTKR 4.4 days, p= 0.44 respectively). Significantly more Morphine was required for Exparel TKR per day (109.6mg, p=0.0009) and per case (31.9mg, $p < 0.0001$) vs non Exparel TKR (78.44mg and 23.71mg). Morphine consumption was not significantly different between RTKR patients. Time to first opiate administration was significantly longer with Exparel TKR (5.24 vs 1.70 hours for the control (p=<0.0001)) and for RTKR (3.72 hours vs 1.07 in the control group (p=0.01)). HCAPS and mean direct cost of care showed no statistical different between Exparel and control groups (p=0.29, p=0.83 respectively).

Conclusion: Exparel significantly increased time to 1st opiate administration, but did not significantly improve LOS, HCAHP pain scores or mean direct cost of care.

1-046

Category: Pain Management

Title: Clinical implication of urine screening in veterans on chronic opioid therapy for noncancer pain

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Purpose: In the Department of Veterans Affairs (VA) health system more than half of patients seen by primary care providers report chronic pain, leading to a high prevalence of chronic opioid therapy. To monitor for opioid use disorder, universal precautions are recommended for all patients on chronic opioid therapy, which includes obtaining pain management agreements and random urine drug screens (UDS). The purpose of this study was to determine how random UDS are being utilized for veterans in primary care, with a focus on how often UDS are conducted and how results affect chronic opioid therapy for noncancer pain management.

Methods: This was a retrospective electronic chart review conducted at Jesse Brown VA Medical Center (JBVAMC) of patients on chronic opioid therapy for noncancer pain with a Pain Management Agreement obtained from October 6, 2012 through September 30, 2013. The study was approved by the institutional review board at the University of Illinois at Chicago and the research and development committee at JBVAMC. The primary endpoints were the percent of patients with baseline UDS conducted when the Pain Management Agreement was obtained and the percent of patients with annual UDS evaluated by a provider. Secondary endpoints included the percent of patients with an inconsistent urine screen, and the percent of inconsistent urine screens that were evaluated and opioid therapy was changed, evaluated and opioid therapy was not changed, or were not evaluated. The average number of urine screens per patient and the average duration between urine screens were also determined. Of patients with inconsistent urine screens, the average number of inconsistent screens per patient was evaluated. And lastly, the percent of patients who had urine screens ordered by a provider but then did not present to lab was analyzed.

Results: 817 patients were identified as having a signed pain management agreement during the designated study period; 119 patients were randomly reviewed and 60 met inclusion criteria. 41.7 percent of patients had a baseline urine screen completed and 68.3 percent of patients had an annual urine screen completed. In terms of secondary endpoints, approximately 47 percent of patients had at least one inconsistent urine screen. Seventeen percent of the inconsistent urine screens were evaluated and therapies changed, 25 percent were evaluated and therapy was not changed and 57 percent were not evaluated by the physician. The average number of screens per

patient was 1.7 screens with an average duration between screens of about 130 days. For patients with inconsistent urine screens, the average number of inconsistent screens per patient was 1.7 screens. Lastly, 43 percent of patients in this study had a urine screen ordered in the year following the signing of the Pain Management Agreement but did not present to lab.

Conclusion: Consistent with guideline recommendations, this study found that urine screens were completed for a majority of patients with a signed Pain Management Agreement.

1-047

Category: Pain Management

Title: Effectiveness and safety of hyaluronic acid injections for osteoarthritis of the knee in a veteran population

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Purpose: Intraarticular hyaluronic acid injections are often used in patients with knee osteoarthritis (OA) who have failed non-pharmacological treatment and other analgesics. Guidelines from the American College of Rheumatology and American Academy of Orthopaedic Surgeons provided no recommendation and did not recommend hyaluronic acid use, respectively. Hyaluronic acid injections remain an option for veterans with OA at Jesse Brown VA Medical Center (JBVAMC) who have failed first-line analgesics, intraarticular corticosteroid injections, and non-pharmacological interventions. Due to conflicting data regarding its efficacy, it is important to evaluate the effectiveness and safety of hyaluronic acid injections for knee OA in veterans at JBVAMC.

Methods: This was a retrospective, electronic chart review approved by the institutional review board at the University of Illinois at Chicago and the Research and Development committee at JBVAMC. The study included veterans with a diagnosis of OA of the knee, who received at least one hyaluronic acid injection in one or both knees at JBVAMC from March 1, 2012 to February 28, 2014. Patient records were followed for a maximum of 6 months after the injection series. Patients were excluded if they had received a hyaluronic injection series prior to the study period. The primary endpoint was the percentage of veterans experiencing moderate or complete treatment response as documented in the electronic medical record (EMR) at the follow-up appointments with the ordering service. Secondary endpoints included the percentage change in pain scores at the initial and the follow-up appointments, the percentage of patients who experienced complete, moderate, minimal, or no relief, and the percentage of patients who experienced an adverse drug reaction (ADR) or were lost to follow-up.

Results: Of the 75 patients included in the study, 12.0% of patients met the primary endpoint of moderate relief with the use of hyaluronic acid injections. Zero patients experienced complete relief, 12.0% experienced minimal relief, and 21.3% of patients experienced no relief. Fifty-two percent of patients were considered lost to follow-up, and two patients experienced an ADR. The median pain score at the initial and follow-up appointments improved by one point, from 7 to 6.

Conclusion: Although relatively well-tolerated in a majority of patients, few patients followed at the JBVAMC experienced moderate or complete relief with use of viscosupplementation.

1-048

Category: Pharmacokinetics

Title: Validation of A-Priori Methods for The Determination of Lithium Clearance and Daily Dosage Requirements

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Purpose: Several methods were found to maintain lithium therapeutic level at steady state. A priori methods were established based on patient demographic data, laboratory results and mathematical models for the determination of lithium dose, serum concentration and clearance. The aim of this study is to compare the precision and bias of a-priori methods in the prediction of daily dosage requirements of lithium and its clearance in psychiatric patients and ascertain the applicability of these methods to Saudi patients.

Methods: A retrospective study, which carried through review the medical records of 60 patients from Al-Amal Complex for Mental Health and King Khalid University Hospital. The dosing requirements and the clearance of lithium were calculated using different a-priori methods (Empirical Method, Jermaine et al, Terao et al, Zetin et al and Abou-Auda et el). Mean Prediction Error was used as a measure of bias while Mean Absolute Error and Root Mean Squared Error were used as a measure of precision.

Results: All methods predicted the clearance of lithium and the dose requirements with varying degrees of bias and precision. RMSE for prediction lithium clearance in empirical method, Jermain and Abu-Auda was 29.37, 30.81, and 27.85 retrospectively. And RMSE were 416.4 , 513.7 and 295.6 for Zetin, Terao and Abu-Audah retrospectively. All methods underestimated predicted dose. Precision was best with the method designated by Abou-Auda et al. also bias of prediction was the least with the method of Abou-Auda et al.

Conclusion: Abou-Auda et al. method proved to be the one with the least amount of deviation i.e. least biased and more precise.

1-049

Category: Pharmacy Law / Regulatory / Accreditation

Title: Drug Supply Chain Security Act VA Mid-South CMOP journey to compliance

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Purpose: The Drug Supply Chain Security Act (DSCSA), signed into law in November 2013, provides sweeping regulatory legislation to assure the integrity of legend pharmaceuticals in the United States. This Act establishes incremental milestones ending in November 2023 where pharmaceutical manufacturers, re-packagers, wholesale distributors, third party logistics providers, and dispensers must participate in an electronic package-level traceability system. The first two milestones required pharmaceutical trading partners to be authorized, transact required data, quarantine, investigate and report suspect product. Additionally, each trading partner must be able to store, manage and report on these transactions, and only transact with authorized trading partners.

Methods: In February 2011, the project management staff at the VA Mid-South Consolidated Mail Outpatient Pharmacy (CMOP) began to work with the California Board of Pharmacy and contribute to the regulatory requirements of the California Drug E-Pedigree law that would sunrise January 1, 2015. This collaboration led Mid-South CMOP to construct (with Abbott, McKesson, and GHX) a first-of-its-kind track and trace pilot to gather relevant information about supply chain transactions. Upon the pilot's successful completion, four projects were subsequently launched to identify CMOP serialization readiness and interoperability requirements. The first project, Serialization Readiness and 2D Barcodes launched April 2013, succeeded in creating organizational awareness by educating and in-servicing key CMOP stakeholders about DSCSA legislation on a recurrent basis. The second project, Drug Pedigree launched November 2014, succeeded in identifying requirements for software modification to the organizations information technology architecture to enable data capture and storage consistent with the DSCSA requirements. The third and fourth projects, also launched November 2014, focused on the acquisition and installation of visual scanning technology for 2D data carriers and the interoperable exchange of electronic information, respectively. The project management staff then harvested the lessons learned and outcomes for use as requirements to ensure compliance with DSCSA.

Results: A software application was developed to capture the required transactional data for all legend pharmaceutical purchases made by Mid-South CMOP. This application assures supply chain integrity by capturing the product transactions and validating this transaction data against

active vendor licensure data from each State or Territory of business registration. By capturing the electronic transaction data provided for each purchase order, logistics personnel validate each transaction against authenticated trading partner data prior to the products receipt into fulfillment. Product history may be traced by purchase order number or NDC number, and the required transaction history is archived and readily retrievable. Currently, 87 vendors are authorized in the system and 34,170 transactions are recorded.

Conclusion: The experience and knowledge gained from the pilot, together with outcomes from the four projects, clearly demonstrate that required compliance with DSCSA roll-out is achievable, and to date, achievable within the time frames established by the legislation. Mid-South CMOP successfully pioneered a process that meets the DSCSA compliance today, and provides a strong foundation for being able achieve compliance as the remaining regulatory dates approach. Electronic data capture with active validation of trading partner licensure provides a significant increase in supply chain product integrity assurance and therefore greatly enhances patient safety.

1-050

Category: Pharmacy Technicians

Title: Transition of care

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Purpose: We have created a pilot series position called transition of care to assist admitted patients with obtaining new medications at discharge in a timely and affordable manner.

Methods: When patients are admitted to the hospital we visit them in their room to update pharmacy insurance benefits as well as find out where they would like to have their discharge medications filled. While in patient we follow up with their insurance about any new medications that they start to make sure they will be a covered benefit as well as be affordable. If any prior authoriazations, plan limitations, or copay assistance is needed, we get things straightened out so everything is ready by their time of discharge.

Results: Patients are able to pick up their new medications at the hospital pharmacy or any pharmacy of their choice without the hassel of not being able to obtain the medications due to insurance issues and or unaffordable copay costs.

Conclusion: Medication compliance is extremely beneficial due to our services and patients are able to be discharged on time without being held longer due to not being able to obtain important medications.

1-051

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of Transitions of Care Pharmacist in a tertiary care center

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Purpose: Effective on October 2012, the Centers for Medicare and Medicaid Services (CMS) started reducing payments to hospitals with excess readmissions as required by the Affordable Care Act. Major drivers for hospital readmission include inaccurate medication reconciliation, inadequate medication education and inconsistent coordination of care across care settings. At Stanford Health Care, a new service line of Transitions of Care (ToC) Pharmacists was introduced to help with prior to admission medication histories, reviewing discharge medications, and providing discharge medication education.

Methods: Baseline metrics prior to implementation of the ToC Pharmacists were obtained using a retrospective chart review. An independent reviewer screened for discharge medication discrepancies between the physician written Discharge Summary and the patients After Visit Summary (AVS). The same reviewer conducted the same review of patients charts after the implementation of the ToC program and the rates of discrepancies were compared. The discrepancies were separated into the following categories: incorrect medication, missing instructions, duplicate medications, and missing medications. Additionally the interventions made by ToC pharmacists were quantified and documented. The baseline period was defined between May to August of 2013, and the post-ToC period was defined as November 2013 to January 2014. October 2013 was defined as the wash-out period.

Results: In the pre-ToC period, 121 patients charts were reviewed. Of the 121 patients, 50 patients had a least one medication discrepancy on discharge comparing the Discharge Summary and the After Visit Summary (error rate = 41%). In the Post-ToC period, 90 patients charts were reviewed and 15 patients had at least one medication discrepancy on the AVS (error rate = 17%). The difference was statistically significant ($P<.001$) and corresponds to a 58.5% relative decrease. The most common errors recorded were having incorrect medications or missing medication information on the After Visit Summary. The ToC pharmacists documented a total of 693 interventions, where the most common interventions were incorrect frequency/dose/duration and access issues/formulary.

Conclusion: Having Transitions of Care Pharmacists led to a statistically significant decrease in discrepancies and an increased rate of accuracy of the discharge medication list. The Transitions of Care Pharmacists most documented interventions included access issues/formulary issues and

incorrect frequency/dose/duration of therapy. Continued metrics and interventions are being collected to assess the impact of the Transition of Care Pharmacists on patient outcomes.

1-052

Category: Preceptor Skills

Title: Comparison of performance by two pharmacy resident cohorts on an objective structured clinical examination

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Purpose: The Objective Structured Clinical Examination (OSCE) is a frequently used and effective assessment for evaluating the clinical and communication skills of medical residents and health-care professions students. An OSCE consists of multiple simulated, realistic patient encounters in which various clinical tasks are performed by examinees. Use of the OSCE may serve as a novel way to provide an additional assessment of pharmacy resident competence and performance. The purpose of this study was to evaluate pharmacy residents ability to communicate, apply knowledge and use their clinical skills in simulations of commonly encountered patient scenarios using an OSCE.

Methods: Post-graduate year 1 (PGY1) and post-graduate year 2 (PGY2) pharmacy residents completing local residency programs were invited to participate in one OSCE in the spring of 2014 and one OSCE in the spring of 2015. The study was approved by the institutional review board and study participation was voluntary. Both OSCEs were developed by an OSCE task force consisting of four school of pharmacy faculty members. The OSCE stations were developed to assess selected American Society of Health-System Pharmacists (ASHP) residency program goals. Station design included outpatient and inpatient settings with patient and physician interactions. Resident performance was evaluated by a clinical skills and a communication checklist. The clinical skills checklists included 10-15 items with detailed answers to allow for reliable assessment of performance. Communication checklists evaluated clear and logical communication, professionalism, and empathy. Residents completed a four or five station OSCE in 2014 and a five station OSCE in 2015. Standardized patients completed the checklists and were trained by the OSCE task force. Median communication and clinical skills scores were evaluated with competency considered to be 70% or greater on each of the ASHP goals. Performance on the inpatient and outpatient OSCE stations were also compared.

Results: A total of twenty-one residents from four pharmacy residency programs completed an OSCE. Eight PGY1 residents and one PGY2 resident completed the OSCE in 2014 and eleven PGY1 and one PGY2 resident completed the OSCE in 2015. All PGY1 and PGY2 residents from both years scored well and showed competence on the communication checklist. The median OSCE communication score was 100%, with a range of 98.5 to 100% in 2014, and 98.38%, with a range of 91.57% to 100% in 2015. The residents median OSCE clinical skills score of 87.5%,

with a range of 80.9% to 100%, in 2014 demonstrated competence. In 2015, the median clinical skills score of 60.50%, with a range of 58.78% to 69.31%, did not meet competence. Depending on the ASHP goal, scores ranged from 43.34% (ASHP goal 2.5: make and follow up on patient referrals) to 100% (ASHP goal 2.8: recommend or communicate regimens and monitoring plans). Clinical skills scores were also assessed by case type and there was not a significant difference in performance among the inpatient case and outpatient cases for either year.

Conclusion: The OSCE was successfully implemented for residents from multiple programs and provided an additional objective assessment for the residents and residency programs. The results of the OSCE will lead to improvement in future OSCEs for pharmacy residents and could potentially enhance evaluation of postgraduate training. Implementation of an OSCE may be an effective tool for assessment of the ASHP PGY1 Pharmacy Practice Residency Standards, Goals and Objectives.

1-053

Category: Preceptor Skills

Title: Incorporation of residents in practice management activities at VA Central Iowa Health Care System

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Purpose: Developing leadership and management skills within a pharmacy practice residency is critical to the future of the profession. The practice management learning experience at VA Central Iowa Healthcare System incorporates active participation in formulary management, performance improvement, cost containment, medication use evaluation and management related activities. Communication skills, both written and verbal, are emphasized as residents learn a variety of skills fundamental to future leadership roles. The resident is provided multiple opportunities to present in formal and informal settings to different audiences, including facility administration.

Methods: In addition to a traditional leadership team, the pharmacy service at VA Central Iowa has a pharmacist serving in pharmacoencomics. This pharmacist is responsible for development and monitoring of cost avoidance and cost containment activities for the department. A variety of safety activities, including medication use evaluations, management of drug shortages and recalls and interpretation of changes in medication risk, are also assigned to this individual. Formulary management efforts are led by a small team of pharmacists who review non-formulary requests for the facility. The practice management learning experience is co-precepted by a lead formulary management team member and the pharmacoeconomic pharmacist. The resident participates in practice management activities one and one-half days per week during ambulatory care clinic rotations (two ten-week blocks). Residents also have dedicated project time during the December block to work on a project with the national clinical pharmacy practice office. Residents interact with pharmacy leadership team members during the course of the residency year to gain exposure to management topics such as budget and resource management and regulation. The pharmacoeconomic pharmacist collaborates with the pharmacy leadership team to identify time for these discussions and unique activities that may be available during the residency year.

Results: The practice management learning experience offers the resident hands on experience in a variety of leadership activities. Residents review and respond to non-formulary requests one day per week (during the experience). Residents develop critical thinking skills by discerning if the request is clinically appropriate or if formulary alternatives are available. Residents learn

communication skills both through formal chart documentation and verbal conversations with providers and patients. In addition to expanding upon their clinical knowledge, residents learn how to communicate messages that may not be well received. The resident is able to complete several ASHP requirements including development of a drug monograph, preparation of newsletter articles, completion of a comparative drug review, participation in all aspects of a medication use evaluation and performance improvement and development of educational programs with the pharmacoeconomic pharmacist. Residents also actively participate in Pharmacy and Therapeutics committee and leadership series. The pharmaceoncomic pharmacist works closely with the leadership team to identify additional opportunities for residents including peer review, strategic planning, regulations, budget, inventory and resource management. Though projects vary each year, residents are involved in activities that are needed by the department or facility contributing to a more meaningful learning experience

Conclusion: The practice management learning experience at VA Central Iowa engages first year pharmacy residents in activities that may be pertinent to their future pharmacy careers. While the residents may not be continuing in formal management roles, they have demonstrated an improved understanding of performance improvement, management issues and activities essential to advance the profession. Residents have opportunities to improve communication skills, actively contribute to formulary management, patient safety and cost avoidance initiatives and assist with identification and monitoring of medication or process related issues facing the service.

1-055

Category: Quality Assurance / Medication Safety

Title: Developing standardized workflows to reduce the risk of errors with U-500 insulin patients

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Purpose: As the use of U-500 insulin grows, so do the number of errors, mostly related to dosing confusion caused by not having a syringe with a U-500 scale. Our goal was to develop a safe workflow to manage patients receiving U-500 insulin during their inpatient stay.

Methods: A failure mode and effects analysis (FMEA) was developed to identify areas of risk associated with the use of U-500 insulin. A multidisciplinary team was assembled to address the identified risks and included representatives from endocrine, nursing, nutrition, pharmacy, and IT. Key senior leaders were engaged to assist with the implementation and communication. The team's mission was to develop standardized workflows for management of the patient from the point of admission through discharge.

Results: The team developed a policy and procedure for the management of U-500 insulin patients. Once a U-500 insulin order is entered, an endocrine consult is generated, nutrition is notified and pharmacy begins to process the order. At this time, the pharmacy preparation checklist is initiated which guides order verification, order preparation and order dispensing. The U-500 insulin is dispensed by pharmacy in a kit with pre-filled syringes, labeled as high-alert and includes a 24-hour supply of barcoded, patient-specific doses. Nursing utilizes bedside barcode scanning and a standardized checklist which incorporates coordination of meal delivery and a nurse-witnessed dose double check at the point of administration. Once the patient is ready for discharge, the pharmacist is notified and works with the prescriber to prepare the discharge medication orders and education for the patient. Since implementation, we averaged 2-3 patients per month on U-500 insulin.

Conclusion: Given the increased use of concentrated insulin, it is imperative to develop safe handling procedures for these medications to keep our patients and staff safe. Performing an FMEA helped identify opportunities and key stakeholders to develop sustainable interventions to ensure standardized workflow when handling this high-alert medication. We have used this same approach to develop similar procedures for the other hospitals in our health system.

1-056

Category: Quality Assurance / Medication Safety

Title: A Multidisciplinary Approach to Reduce Hypoglycemia in the Adult Medicine Population

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Purpose: Hypoglycemia in insulin treated patients is associated with adverse events, increased length of stay and increased mortality. Vidant Medical Center (VMC) patients who experienced a hypoglycemic episode had an increased mean length of stay of eight days and a mortality rate four times higher than those who did not experience hypoglycemia. Chart reviews identified multiple causes of hypoglycemia including excessive insulin dosing, renal impairment, decreased nutrition, and resumption of home insulin doses. A multidisciplinary group consisting of providers, nurses, pharmacists and dieticians was created to reduce the rate of hypoglycemia.

Methods: Pharmacists received targeted education and a check list was created to allow for a consistent approach for identified patients. Decentralized pharmacists utilized a daily report that allowed them to identify AMS patients with an order for scheduled insulin, oral diabetic medications, or both and a blood glucose less than 100 mg/dL in the previous 24 hours. The decentralized pharmacists reviewed the patients chart for insulin dosing, renal function status, nutrition status, the initiation or discontinuation of steroids and blood glucose trends. For those patients with excessive doses or those with a change in clinical status, the provider was contacted to adjust the insulin regimen in an effort to prevent a hypoglycemic episode. In addition to pharmacist involvement, four other multidisciplinary interventions occurred concurrently. These included focused education for internal medicine and family medicine residents, hospitalist performance feedback, nursing education and feedback on hypoglycemia protocol compliance, and safety event reporting.

Results: During the study period from September 2015 through December 2015, 1,968 patient charts were reviewed and decentralized pharmacists intervened on 162 patients. Of these interventions, the pharmacist recommendations were accepted 97 percent of the time by providers. The rate of hypoglycemia amongst AMS diabetes patients decreased to 1.2 percent, mean LOS decreased from 7.3 days to 6.7 days and mortality rate decreased from 5.8 percent to 5.6 percent.

Conclusion: In evaluating these data, the strategies associated with the largest impact were pharmacist review and interventions, internal and family medicine education and hospitalist education. Utilization of a focused report made identification of patients at risk for hypoglycemia manageable for the pharmacists. As a group, their recommendations were standardized and

welcomed by providers. Based on these results, the service has been expanded to surgical and cardiovascular patient populations.

1-057

Category: Quality Assurance / Medication Safety

Title: Hypoglycemia Incidence after Implementation of Inpatient Insulin Protocol

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Purpose: Hypoglycemia is a major complication in the inpatient management of patients with high blood glucose. In November 2013, the San Francisco Veterans Health Care System (SFVAHCS) changed from a sliding scale regular insulin (SSI) order set to basal bolus insulin (BBI) order sets for the inpatient and long-term care units. Our study aimed to compare the safety of the new BBI order sets to the SSI order set by evaluating the incidence of hypoglycemic events before and after implementation.

Methods: This study was a single-center, retrospective chart review to determine the safety of the BBI protocol by evaluating the incidence of hypoglycemia before and after implementation. The study period consisted of the pre-intervention period of January 1 July 30, 2013 and the post-intervention period of January 1 July 30, 2014.

Results: 668 patients were prescribed regular subcutaneous insulin during the pre-intervention period, and 29 patients had hypoglycemia. 629 patients were prescribed aspart subcutaneous insulin during the post-intervention period, and 20 patients had hypoglycemia. The post-intervention group trended towards a lower rate of hypoglycemia (3.2%) compared with the pre-intervention group (4.3%), but this difference was not significant ($p=0.34$). Patient characteristics differed significantly in terms of mean age ($p=0.016$), weight ($p=0.00094$), body mass index ($p=0.018$), average baseline hemoglobin A1c ($p=0.0028$), and proportion of patients prescribed non-antidiabetic hypoglycemic agents ($p=0.049$).

Conclusion: After implementation of inpatient BBI order sets at the SFVAHCS, a small but statistically insignificant decrease in hypoglycemia was observed.

1-058

Category: Quality Assurance / Medication Safety

Title: Implementation of a risk evaluation and mitigation strategy (REMS) drug survey to assess adherence in a multi-hospital system

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Purpose: Drugs designated with a risk evaluation and mitigation strategy (REMS) with an elements-to-assure-safe-use (ETASU) component carry increased potential for patient harm if not overseen appropriately. Each REMS program necessitates different requirements based on the Food and Drug Administration's approval for safe use. The differences and nuances of these programs can be a source of confusion to practitioners; which in turn can result in a pharmacy's unintentional noncompliance. An assessment tool was developed to identify post-implementation compliance variations of these programs in a multi-hospital system.

Methods: The clinical informatics pharmacist and the medication safety officer developed an assessment tool to evaluate 54 individual REMS agents which have ETASU components. The assessment was broken into four separate surveys and published weekly. The pharmacy managers at the 10 inpatient pharmacies and two retail pharmacy locations in the health-system responded to the survey. The assessment was available in hard copy and electronic format via Survey Monkey. The questionnaire covered the following, if required, for a given agent: if the agent is dispensed at that location, if the location was enrolled in the appropriate REMS program, the name of the program designee if enrolled, the professional person who distributes the medication guide to the patient, if the pharmacist completed the required education, and if the pharmacist verifies the prescriber and/or patient enrollment before dispensing. The data collection period was six weeks. The pharmacy managers were sent individual opportunities for improvement and were required to report progress in two weeks.

Results: The average number of reported REMS ETASU agents dispensed in the inpatient and retail setting were 12 and 11 agents respectively. The retail pharmacies reported 100 percent compliance with zero program discrepancies. The inpatient pharmacies reported an initial average compliance of 75 percent. Thirty-three discrepancies were noted system-wide for REMS ETASU program non-compliance. These discrepancies consisted of 48 percent program designee not identified, 42 percent unfulfilled pharmacist education requirements, and 9 percent unknown medication guide distribution. The distribution of pharmacy discrepancies resulted in the increase of average compliance to 99 percent for the inpatient settings, accounting for a 32 percent increase over baseline.

Conclusion: Inpatient and retail pharmacies are required to follow REMS program ETASU components. Inpatient implementation varied with agent. The success of these programs resides

with the program designee and their ability to provide oversight and education for each REMS ETASU agent. Our survey aided the pharmacy managers in discovering unnoticed discrepancies in their own REMS program adherence. One agent, representing one percent non-compliance, used to treat antipsychotic episodes is under clinical review to determine if the providers of that hospital wish to continue to offer this therapy option on their inpatient units.

1-060

Category: Quality Assurance / Medication Safety

Title: System redesign of the oral chemotherapy prescription processing to improve patient safety

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Purpose: Chemotherapy medications are high alert agents with a risk of causing harm when used in error. Historically, institutions have strived to ensure safe practices involving intravenous chemotherapy. Recently, there has been an increase in prescribing oral chemotherapy agents. The focus needs to be shifted to include implementation of standardized processes when managing oral chemotherapy. The institutions Medication Event Team discovered medication errors and delays related to oral chemotherapy medications. The goal of this team was to implement a standardized approach to ordering, dispensing, communicating, and documenting oral chemotherapy medications in order to improve timely and safe dispensing of these agents.

Methods: The Medication Event Team traced the entire oral chemotherapy process to better understand the current state, evaluated each step within the system, and identified gaps that may have ultimately led to the medication errors. A formal root cause analysis was conducted in an effort to improve the process and prevent error recurrence. Root causes were identified, specific action plans were developed for each identified root cause, and outcome measures were established in order to show adherence to the newly developed action plans and demonstrate sustainment of the goals.

Results: The two identified root causes include (1) variability and inconsistencies in filling and dispensing of oral chemotherapy prescriptions may have contributed to a delay in patients receiving oral chemotherapy, and (2) inconsistent processes for communication between patients and the oncology healthcare team may have contributed to a delay in patients receiving oral chemotherapy. Action plans that were developed include (1) Installation of a software application in order to standardize the ordering of oral chemotherapy medications; (2) a double check system was implemented for oral chemotherapy to include clinical appropriateness and a final verification performed by two oncology clinical pharmacists; (3) a specific storage area was designated to store filled oral chemotherapy prescriptions awaiting patient counseling; (4) a signature required designation was mandated for oral chemotherapy prescriptions to be mailed in order to confirm receipt; (5) an oral chemotherapy hotline was established to improve communication with the oncology clinical pharmacists; (6) an oral chemotherapy informational pamphlet was designed and distributed to patients to enhance their understanding of the oral

chemotherapy process and provide instructions on how to reach oncology clinical pharmacists; (7) a designated clinical oncology progress note was created to improve documentation and communication within the oncology healthcare team.

Conclusion: Implementation of a standardized and consistent process for processing oral chemotherapy medications improved communication amongst the oncology healthcare team and allowed for timely dispensing of oral chemotherapy medications to patients. Ultimately, the redesign of the process effectively identified system weaknesses, removed vulnerabilities in the process, and enhanced overall patient safety.

1-061

Category: Quality Assurance / Medication Safety

Title: Assessment of pharmacy technician accuracy in obtaining medication histories: a retrospective quality improvement project in the emergency department

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Purpose: Accurate medication histories are an imperative component of medication safety for hospitalized patients. Traditionally nurses and physicians have obtained medication histories, but time restrictions and simultaneous responsibilities potentially limit their ability to obtain accurate and complete results. We have recently initiated a pharmacy technician driven medication history program in our emergency department (ED). The objective of our study was to compare the accuracy of pharmacy technician and nurse/physician obtained medication histories.

Methods: This was a retrospective, quality improvement project performed in the ED of a single academic medical center. As a quality improvement project, this analysis met criteria for Institutional Review Board exemption. At our institution, pharmacists periodically repeat medication histories to assess process accuracy. In an anonymized database, pharmacists document the professional designation of the individual originally obtaining the medication history and the number of observed discrepancies. A single reviewer retrospectively reviewed data from a four week period in the database. Medication histories were considered accurate if the pharmacist reviewer did not identify any discrepancies. The primary outcome compared the percentage of accurate medication histories in each group (pharmacy technician versus nurse/physician). The secondary outcome compared the number of identified discrepancies between the groups. Categorical variables were compared using the Chi-square test for independence or the Fisher Exact test. Continuous variables were compared using the Mann-Whitney U test. A p-value < 0.05 was considered statistically significant.

Results: During the four week review period, a pharmacist repeated 25 medication histories; 12 were initially obtained by a pharmacy technician, 12 by a nurse and 1 by a physician. The nature of the discrepancies was not explicitly recorded in all circumstances but the most common documented discrepancies included errors in formulation and dosing frequency. Pharmacy technicians obtained accurate medication histories significantly more often when compared to nurses and physicians (8/12, 66.7% vs. 2/13, 15.4%, $p = 0.015$). Fewer discrepancies were identified with medication histories preformed by pharmacy technicians (median (IQR) 0 (0 1) vs. 3 (3 4), $p = 0.001$).

Conclusion: In this small retrospective analysis, medication histories obtained by pharmacy technicians were more accurate when compared with nurses and physicians. Pharmacy technicians can potentially reduce medication errors through the attainment of more accurate medication histories while reducing the workload for other healthcare providers.

4-001

Category: Administrative practice / Financial Management / Human Resources

Title: Leveraging drug shortages and price increases to optimize formulary management

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Purpose: Increasing drug shortages present significant safety and budgetary concerns for hospitals across the nation. Not only must pharmacies cope with limited availability of certain drugs, but also with sudden price increases of commonly used agents. The process of finding effective alternatives, educating staff, and implementing therapeutic substitutions is exhaustive. There is, however, a silver lining. Drug shortages and exorbitant price increases can become the impetus for reviewing formulary alternatives, thus achieving two goals at once: meeting the requirement to review the hospital formulary regularly and helping to find more cost effective alternatives.

Methods: Initiatives took place between October 2014 and June 2015. To best evaluate formulary alternatives, the American Society of Health-System Pharmacists (ASHP) Guidelines on Formulary System Management and Technical Assistance Bulletin on the Evaluation of Drugs for Formularies were used. Literature searches were carried out using various drug information resources, both online and in print. Pharmacy prepared a drug monograph of the proposed formulary alternative and an impact statement describing the need for a substitution due to a given drug shortage. The following items were also included in the statement: expected duration of the shortage and amount of remaining drug left in stock. The monograph included generic and trade names, look alike sound alike concerns, drug class, indications and dosage, dosage forms, bioavailability, pharmacokinetics, adverse effects, toxicity, special precautions, comparative efficacy, cost comparison, operational considerations, and final recommendations. The monographs were presented to the Pharmacy and Therapeutics (P and T) Committee for discussion, revision, and approval.

Results: Drug shortages led to formulary reviews of topical cocaine and oseltamivir. Price increases forced the reviews of vasopressin, Donnatal elixir, and intravenous acetaminophen. A literature search found lidocaine with epinephrine solutions and oxymetazoline to be equally efficacious to topical cocaine for nosebleeds, at 0.6 percent of the cost. Topical cocaine was removed from formulary, saving 3,000 dollars per month. Oseltamivir was being prescribed beyond the recommended five days. A review led to a five day duration limit. Vasopressin underwent a prohibitive price increase during the study period. It was stocked in 30 crash carts across the hospital but was rarely utilized in emergency code blue situations. It was removed from all crash carts and reserved for continuous infusions, as an alternative to first line options, decreasing inventory holdings by 66 percent. Donnatal elixir was reviewed and found to have no

clinical benefit for abdominal spasms. It was removed from the gastrointestinal cocktail recipe and from formulary, thus reducing the cost per dose by 95 percent. Intravenous acetaminophen was reviewed and found to be overused in patients able to take oral agents. This finding led to a dosage restriction policy and the development of a multimodal pain management order set.

Conclusion: Managing drug shortages and staying ahead of significant price increases, is a laborious undertaking, requiring extensive time and effort to seek out equally efficacious options and provide staff education. Pharmacies do not always have the requisite resources to evaluate all formulary agents thoroughly or to stay abreast of every new treatment paradigm. Medication usage evaluations prompted by drug shortages or price increases can benefit hospitals greatly by helping to prioritize medication usage evaluations, highlighting more cost effective alternatives, improving inventory management, and emphasizing the need for other clinical enhancements such as order sets and evidence based prescribing guidelines.

4-002

Category: Administrative practice / Financial Management / Human Resources

Title: Evaluation of the impact of expanded roles by pharmacy student employees in an inpatient setting

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Purpose: Pharmacy involvement in direct patient care in the inpatient setting was identified as a focus during the 2014 Annual Strategic Planning meeting. Although pharmacy students hold traditional technician roles in many hospital pharmacies, pharmacy students are capable of operating as pharmacist extenders. This project was designed to increase pharmacy presence and involvement in direct patient care through completion of medication histories and patient education by students. Success of the program was measured through calculation of the financial impact of student employee involvement, evaluation of the impact to the student experience, and assessment of pharmacist satisfaction with the expanded student role.

Methods: IRB approval was obtained for the project and students provided informed consent to be interviewed regarding their experience. Student employees were trained to obtain medication histories, patient education and attended rounds with pharmacists. Students documented interventions and cost avoidance was calculated related to their activities. The students were involved with medication safety journal club review related to occurrence reporting, disclosure of medical error, followed with review and categorization of actual medication-related events. Interviews with the students were conducted related to the impact of their enhanced roles on coursework and IPPE experiences. Pharmacists who worked with and mentored the pharmacy students while they were assisting with patient care activities were anonymously surveyed.

Results: The students completed 456 interventions during a seven month period resulting in over $51,000 in cost avoidance. From 2013 to 2014, HCAHPS scores related to medication-specific questions improved by 10 percent in which the increased student involvement may have helped impact. Two students were interviewed regarding the perceived impact of the expanded student roles which indicated many positive aspects including increased clinical knowledge, enhanced understanding of patient and medication safety issues, and the opportunity to participate in patient care with a multidisciplinary team. Twenty out of twenty-five eligible pharmacists completed the survey. The pharmacists indicated that the students were well-trained and capable of providing these services and were very satisfied with student involvement in assisting them in providing direct patient care. The majority of pharmacists also reported that student involvement in these activities allowed them to be involved in more clinical aspects of care. One hundred percent of pharmacists surveyed requested expansion of the student employee program.

Conclusion: The expanded activities completed by pharmacy student employees resulted in an increased number of patients impacted by pharmacy staff, promoted patient interaction, increased the accuracy of medication lists, generated cost avoidance, enhanced clinical advancement and medication safety knowledge for students and increased clinical pharmacist satisfaction. The student program has now been increased to eight students who initially complete technician training and advance into standardized training related to obtaining medication histories and providing patient education.

4-003

Category: Administrative practice / Financial Management / Human Resources

Title: Utilizing a shared database with multiple entry points to enable health system dashboard production

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Purpose: Organizations surveying healthcare systems functioning as one provider expect to survey one entity not multiple disconnected entities. Part of being one provider is the provision of consolidated data which can be challenging because different sites may produce similar, but not comparable data. This project was designed to address this issue for the pharmacies in a small healthcare system consisting of two hospitals, a cancer center, and multiple clinics. It was combined under one provider number and surveyed by an accrediting organization as one facility. The accrediting organization noted that it expected the system to function as one, not individual pieces.

Methods: To facilitate the move to one provider and data set, the decision was made to create a space on the intranet that would allow users from multiple locations to enter data into a single space. The space was secured by Information Technology, allowing limited personnel to enter data, and a larger group to view the data. An initial dataset, based on information selected for presentation to the shared Pharmacy and Therapeutics Committee, was chosen for inclusion by the directors of pharmacy. The spreadsheet was prepared, protected, tested, and placed on the hospital portal. Selected information included physician specific unapproved abbreviations, conscious sedation reversal, intervention outcomes, medication use evaluation, and reconciliation. Other data points included adverse drug reactions, anticoagulation data, glucose trends, medication errors, automation statistics, and recalls. The data can be entered by multiple departments from multiple locations. The database combines the data, performs calculations, and prepares dashboards that are used by personnel across the system. The initial dashboards included Pharmacy and Therapeutics, administrative, nursing, and quality.

Results: Implementation of the shared space was not without challenges. One of the facilities struggled collecting certain data points. This resulted in modification to the initial collection tool. There were also some turf issues. By the end of the first year, there was good buy in from most of the involved parties. The database continues to evolve. It has undergone multiple modifications to better meet the needs of its various users. The database is now used for collecting data utilized for preparing physician scorecards. The shared space further functions as a repository for improvements made in the facilities, as it includes an area for accomplishments/ideas. This allows viewing of improvements made by one facility or department across the system, creating more awareness of system improvements and providing everyone with ideas for improvement in their respective areas. The person in charge of accreditation for the system has chosen to expand this process to all quality reporting across the system.

Conclusion: The use of a shared data collection point has been successful in providing system data for use in improvement activities.

4-004

Category: Administrative practice / Financial Management / Human Resources

Title: Trends of educational fund dollars utilized in professional development, technology and drug information by preceptors in a unique hub site model: four years later

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Purpose: As a result of budget reductions among pharmacy employers, The University of Findlay College of Pharmacy has created a special account to support the needs of preceptors taking advanced pharmacy practice students within our hub site model. This commitment demonstrates the support to pharmacy preceptors and sites where advanced pharmacy practice students are placed within a unique hub site model. Retrospective spending data over a four-year period has been evaluated to identify the trends and educational needs of preceptors in three areas: technology, drug information, and professional development.

Methods: Each hub site is allowed to allocate up to half of their yearly assigned student disbursement into the educational fund. Preceptors under the hub site model submit their request to the experiential office using a form categorizing the type of expenditures for tracking purposes. The expense submissions are reviewed to assure that they meet the criteria of the educational fund. Once expenses are approved, payment is made. An excel spreadsheet was designed to track the total dollars allocated to the carve-out fund by each hub site, the remaining amount of dollars after each submission, and how the funds were utilized among the three main categories. Data can be extracted by each individual hub site or collectively among all sites. The following reported data is presented in the collective manner to protect anonymity. This has been an ongoing process for the past four years. A dedicated experiential department person manages the process of budget, submissions, categorizing, and payment and is reviewed by the Director of Experiential Education. This process keeps reporting consistent and efficient for all involved.

Results: A four-year retrospective comparison of educational fund expenditures identifies several trends. In 2010-2011 The University of Findlay college of pharmacy partnered with 23 hub sites allocating 71,000 dollars in the educational fund, averaging 3,086 dollars per site compared to 33 hub sites in 2014-2015 designating 109,500 dollars in the fund averaging 3,318 dollars per site. The largest changes in distribution of funds were seen in the increase of dollars used for professional development and a decrease in drug information expenses. In 2010-2011 funds were distributed accordingly: technology 25 percent, drug information 36 percent and professional development 39 percent. Comparatively in 2014-2015 funds were dispersed accordingly: technology 33 percent, drug information two percent, and professional development 65 percent. The number of requests submitted in 2010-2011 was 72 among 23 hub sites, yielding an average of 3.1 requests per site and 986.11 dollars per request. In 2014-2015 106 requests were made among 33 hub sites, yielding an average of 3.2 requests per site and 859.44 dollars

per request. Each year it is noted that educational fund dollars are left unspent. In 2010-2011 13 percent of the dollars were not utilized compared to 17 percent in 2014-2015.

Conclusion: Trends demonstrate professional development and technology are at a stronger demand than drug information resources compared to the start of the educational fund program. The educational fund program has been a unique way to provide technology and support educational needs of preceptors and their specific areas of practice. While our preceptors are continually expanding their knowledge, they can share their expertise with students. The college will continue to dedicate experiential personnel and continue the carve out program as a means to provide education to the preceptors, support hub sites, as well as strengthen relationships between the sites and the college.

4-005

Category: Administrative practice / Financial Management / Human Resources

Title: Uncovering hidden opportunities to expand pharmacy revenue

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Purpose: Partners Healthcare System (PHS) pharmacy experienced a gap between budgeted and gross revenues within the ambulatory setting. There was a lack of transparency and limited tracking and analysis around the revenue cycle for clinic-administered medications. An in-depth hospital assessment identified failure to bill for wasted, unused drug product that remains from single-dose vials (SDV). Therefore, a new pharmacy process was needed to bill payers for the appropriate amount of discarded drug (i.e., waste) remaining after dispensing and administering what is reasonable and necessary for the patients condition.

Methods: We created a cross-functional project team consisting of key stakeholders from pharmacy, finance, compliance and revenue cycle departments to evaluate an innovative role for pharmacy to help optimize revenue. We used consultant proprietary software to interface with Partners financial data feeds, enabling massive claim analysis at the line-item level. The team was tasked to identify appropriate pharmacy-specific billing & reimbursement processes needed to support the billing of waste initiative. Gaps were identified and resolved that originally prevented pharmacy from revising patient bills and allowing payment for the amount of drug or biological product discarded in addition to the dose dispensed/administered to the patient. Finally, pharmacy was responsible for revising original total billed dose to include wasted drug and administered dose as one single claim line. Pharmacy was also made accountable for making the necessary documentation in a patients Medical Record to reflect revised billing quantity. We documented program success by identifying new collectable revenue (Realized Value) when remittance data included billed waste units. To monitor for continuous improvement, we tracked Missed Opportunity where potential waste units were not billed on claim data.

Results: Initially, we targeted Infliximab for a pilot implementation due to its high volume and identified total value, which was projected to be $1,558,087 annualized. It took approximately seven months for hospital leadership to approve and finalize department policy and procedures, and ramp-up staffing awareness for pilot implementation. By mid-July 2014, pharmacy began billing for Infliximab waste and quickly drove waste capture rate to 100% by creating standardized billing and documentation procedures. Over a six month period (07/2014-12/2014), $617,656 in Realized Value was billed and collected as the PHS pharmacy transitioned all remaining Infliximab dispensed doses to the waste billing program. Following the pilots success, additional drugs have been added to expand the waste billing program, but are still restricted to ambulatory patients who receive pharmacy-dispensed medications through hospital-based

clinics. After implementation, we found there was a more robust understanding of operational issues regarding reimbursement by hospital leaders, a greater hospital accountability and retention of electronic data interchange (EDI) claims data.

Conclusion: Our project demonstrates that a pharmacy-driven program can generate additional collectable revenue throughout a hospital system, thus positively impacting pharmacy budgets. With continued tracking and monitoring of billing of waste revenues, the program has improved operational efficiency and increased the number of qualified NDCs billed under this initiative. Using consultants and proprietary software, additional resources were available to quickly and accurately distill large amounts of financial claim data required for program approval and successful implementation.

4-006

Category: Administrative practice / Financial Management / Human Resources

Title: Pharmacy student interview skills survey: viewpoint from pharmacy managers and pharmacy students

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Purpose: The preparation of students to become entry-level pharmacists involves many steps. Due to the increasing amount of knowledge necessary to produce a well-rounded pharmacist, one feature that is often overlooked in some pharmacy school curriculums is the preparation and attainment of the skills needed to succeed in post-graduate interviews. This project was designed to identify any deficiencies in University of Louisiana at Monroe School of Pharmacy (ULMSOP) students interviewing skills from the perspective of the students and pharmacy managers.

Methods: Following IRB approval, an electronic survey was administered via an email invitation to senior pharmacy students who participated in the spring career fair and interview day in October 2014 and April 2015. Questions to the students targeted future career pathways and perceived interview readiness and confidence. A separate email invitation was sent to pharmacy managers and district managers that participated in interviewing the senior pharmacy students during the spring interview day. These questions targeted appropriate student responses during the interview and observed readiness for entry into the profession. Data were summarized using descriptive statistics and analyzed for identification of suggested focus areas for improvements for students.

Results: A total of 42 ULMSOP P4 students (50%) completed the student survey and 15 pharmacy/district managers (37%) completed the manager survey. Twenty three percent of students surveyed practiced interviewing with a mentor or faculty member prior to their interview day. The majority (57.14%)of students practiced interviewing etiquette and 59.52% read materials regarding interviewing preparation. Less than half (42.86%) did not participate in programming for resume or curriculum vitae (CV) development. Approximately 41% of students reported that the ULMSOP did not prepare them adequately for their interview. Job offers were extended to 79.49% of the survey participants this year. Responses from the manager survey showed that 60% of the participants thought that most of the CVs of the student pharmacists were professionally completed, and 26.67% thought all were professionally completed. When asked to compare to ULMSOP students in the past, 73.33% of pharmacy managers thought that the current students performed the same, 20% thought ULMSOP students performed better, and 6.67% thought ULMSOP students performed worse than previous students. Eighty percent of

mangers also reported ULMSOP students performance was similar to students from other colleges of pharmacy and 20% reported that ULMSOP students performed better.

Conclusion: Proper interviewing skills are a necessity for graduating pharmacists. The current pharmacy job market is competitive and entry-level pharmacists without adequate interviewing skills may be overlooked when trying to attain employment. These surveys identified perceived deficiencies in the ULMSOP curriculum regarding preparation for employment interviews. These results support the idea that ULMSOP students may be better prepared for employment interviews if a course was available to equip them with the tools necessary for successful employment interviews.

4-007

Category: Ambulatory Care

Title: Maternal exposures: influenza immunization, smoking, and hypertension in Lebanese pregnant women

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Purpose: Influenza immunization is the most efficient intervention to mitigate the burden of influenza disease during pregnancy due to the fact that it predisposes women to complications through physiologic changes in the cardiac, pulmonary, and immune systems. Moreover, blood pressure monitoring and smoking cessation are important concerns to avoid any risk of adverse impact on the unborn child. The purpose of this study was to assess the acceptance rate of influenza vaccination, the prevalence of smoking and the practice of blood pressure monitoring during pregnancy.

Methods: In a community setting, a retrospective multicenter observational was conducted between November 2014 and June 2015, and was approved by the institutional review board of the Lebanese international university. A clinical data collection survey was developed and Lebanese females who have experienced at least one pregnancy signed an informed consent to be included in the study. The PharmD candidates filled 20 variables that required an average of ten minutes for each female. They recorded the included participants' demographics, educational level, income, age of last pregnancy, number of abortions, and past medical history. In addition to that, they collected information that addressed recommendations for immunization and their vaccination status during pregnancy. Data concerning blood pressure monitoring during gestation and their knowledge about the importance of screening to avoid gestational hypertension (GHTN) were assessed. They were also asked about their smoking status before and during gestation. All statistical analysis was performed using SPSS version 20.0 and presented as frequency, percentage and means.

Results: Survey data was analyzed based on 381 females aging 16 to 48 years old (mean of 29.23). The average age of marriage was 21.73, whereas the last pregnancy was achieved at 26.54 years. The females stated that they have conceived around 2.52 pregnancies that resulted in 2.18 live children and a mean of 0.36 abortions. The data showed that 47% received school education, the income included 17.6% getting paid less than 600 dollars, and 13 patients (3.4%) had a history of hypertension. Only 3.4% of the women had been offered the vaccine during the current pregnancy or a prior pregnancy, and were aware of the national recommendations for the importance and safety of influenza immunization. Concerning hypertension, 24 (6.3%) females had GHTN and 7 of those (29.16%) were treated with methyldopa. Nevertheless, the majority of

the mothers reported monitoring their blood pressure during pregnancy (79.3%) and 20.2% confirmed their awareness of the significance of such screening. Last but not least, smoking was reported in 44.1% of the females, of whom 13.4% continued smoking during gestation.

Conclusion: Pregnant women's overall knowledge of the importance of influenza vaccination and blood pressure monitoring was poor. Even though few females continued smoking during their gestation, encouragement for cessation is essential in such a population to reduce the potential maternal and fetal health risks. Therefore, there is a clear need for strategies, from the prenatal care providers and pharmacists, to optimize influenza vaccination, blood pressure monitoring, and smoking cessation among Lebanese pregnant women.

4-008

Category: Ambulatory Care

Title: Assessment of influenza vaccine awareness among adult Lebanese population

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Purpose: Influenza viruses are respiratory pathogens transmitted either through respiratory secretions or through contact with contaminated objects. The annual influenza epidemics based on the WHO fact sheet N211 are estimated to result in about 3 to 5 million cases of severe illness, and about 250 000 to 500 000 deaths worldwide. The objective of this study is to assess the level of awareness, misconceptions, and adherence to influenza vaccination program among adult Lebanese population and evaluate the impact of clinical pharmacist counseling on raising the level of awareness.

Methods: A prospective observational study was conducted from December 2014 till May 2015 over different regions in Lebanon and participants were randomly selected. The study was approved by the Institutional Review Board of the Lebanese International University and a written informed consent was obtained before enrollment into the study. The inclusion criteria include adults Lebanese patients. The exclusion criteria included children, cancer, or neurologic deficit patients. The data collection sheet included a questionnaire about individuals demographics, medical profile, beliefs regarding influenza vaccine, and factors that encouraged or discouraged the patient from taking the influenza vaccine. Patients knowledge about influenza viruses and vaccine efficacy was assessed by the pharmacist before and after counseling, the second assessment was done 12 weeks from the first assessment. The primary outcome measures were to evaluate the level of awareness of patients toward influenza vaccines efficacy based on a set of questions. The secondary outcome measures included patients adherence to the vaccination program before and after counseling and factors that affect patients decision regarding vaccination. SPSS software version, 21 was used to analyze the study results. The paired T-test was used to explore the statistical differences between variables. A P-value <0.05 is considered statistical significance.

Results: From a total of 270 patients enrolled in the study 222 patients (82%) were aware about the influenza vaccine availability. Before pharmacist counseling, 189 patients (70%) versus 270 patients (100%) post counseling stated the right vaccine dose frequency with a p-value <0.001. With respect to patients knowledge about the therapeutic role of influenza vaccine, only 17 patients (7.65%) responded that the vaccine requires a period of two weeks to be fully immunized and only 34 patients (15.31%) stated the difference between common cold and flu

correctly. From those patients who were aware about the vaccine availability, 96 patients (43%) considered that influenza vaccine is ineffective based on their own experience and only 84 patients (31%) took the vaccine once in their life time. The main reasons behind patients reluctant in vaccine administration were lack in both vaccine efficacy (48 patients, 21%) and trust in the available vaccines (38 patients, 17%). Before pharmacist counseling, 84 patients (31%) versus 223 patients (82.5%) post counseling showed interest in influenza vaccine administration with a p-value <0.001.

Conclusion: This study highlights the importance of vaccination awareness campaign to raise patient education about the indication, efficacy and safety. Thus pharmacist can play a vital role in accomplishing such task. This study opens the door for increasing the knowledge among adult Lebanese population regarding the vaccination program and so better results can be detected by targeting larger population.

4-009

Category: Ambulatory Care

Title: A newly developed medication reconciliation and resulting pharmacist interventions in an outpatient internal medicine center

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Purpose: Medication reconciliation in the outpatient setting is an important part of preventing medication errors, and is mandated by the Joint Commission. With abundance of polypharmacy, medication record accuracy becomes a challenge in outpatient settings. Pharmacists are uniquely qualified to conduct medication reconciliation activities, as well as clinical interventions to improve patient safety. This study describes and quantifies a new medication reconciliation service and resulting interventions in an outpatient internal medicine center.

Methods: As part of a new service, a clinical pharmacist and student pharmacists in an academic internal medicine center perform medication reconciliation prior to the medical resident appointment, and use the process to identify the need for clinical interventions such as pharmacotherapy recommendations and patient counseling. All identified discrepancies and interventions are recorded anonymously in a medication reconciliation database. A retrospective review was performed of the information entered into the medication reconciliation database from April 2014 to April 2015. The total number of interviews was reviewed as well as the incidence of each discrepancy and intervention in order to describe the impact of the pharmacist. Discrepancies were defined as medications taken differently than listed in the electronic health record (EHR) per patient reporting, non-adherence with chronic medications, medications no longer taken, medications missing from EHR, medication directions that needed to be clarified or updated, and any over-the-counter (OTC) and herbal medications not listed. Interventions were defined as collaborative encounters with physicians resulting in new therapies added, current therapies changed or discontinued, OTCs recommended, lab recommendations, adverse drug reaction (ADR) identified and prevented and drug - drug interactions (DDI) identified. Descriptive statistics were used to report data quantitatively.

Results: A total of 434 patients in the internal medicine center were reviewed. A total of 3261 medications were reconciled (average of 7.5 medications/patient, range 0-32). A total of 1620 discrepancies were found with an average of 3.7 discrepancies per patient. Medications no longer taken that needed to be discontinued in the EHR were the most common type of discrepancy (29%), followed by prescription medications from outside physicians that needed to be added to the EHR (25%). Medications that were taken differently than prescribed and OTCs and herbal medications that were missing from the EHR were also common (18% and 17%, respectively). Forty medication allergies were documented that had previously not been in the EHR, and 39

allergies were clarified. A total of 405 collaborative interventions were performed with an average of 0.9 interventions per patient. Medication therapy adjustments were the most common type of intervention (37%), followed by initiation of new medications (27%). Patient counseling was performed 216 times during the interviews.

Conclusion: A new medication reconciliation service in an outpatient internal medicine center resulted in correction of many discrepancies. In addition, the service resulted in a number of collaborative interventions to improve patient outcomes. A medication reconciliation service in the outpatient setting presented opportunities to integrate the pharmacist into the care of patients, identified patient education needs, and provided opportunities for collaborative clinical interventions.

4-010

Category: Ambulatory Care

Title: Clinical pharmacist use of the Medometer adherence tool in hypertensive patients, a pilot study

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Purpose: The Medometer is a visual scale that measures adherence to individual medications. It resembles a speedometer, and patients are asked to mark the percentage that best describes the total doses of a specific medication that were taken during the previous 4 weeks on a scale of 0% (no doses taken) to 120% (extra doses taken). The tool has been validated in a geriatric psychiatry population, but has not been tested in patients with hypertension. The purpose of this study was to describe the use of the Medometer adherence tool in hypertensive patients, and characterize interventions resulting from the adherence-based measurements.

Methods: The institutional review board approved this study. A retrospective review was completed of patients who were interviewed by a pharmacist or student pharmacist using the Medometer adherence tool from September to December 2014. Patients taking one or more antihypertensive medications were identified by student pharmacists during routine medication reconciliation activities in an academic internal medicine center and family medicine center. Antihypertensive medication adherence was measured using the Medometer, and adherence measures were used as the basis for patient counseling and drug therapy recommendations. Descriptive statistics were used to characterize adherence patterns and resulting interventions, and their relationship to BP control.

Results: A total of 44 patients were included who were on an average of 2 antihypertensives (range 1-6). The average age was 58 (range 24-83) and 68% were female. The average blood pressure was 152/87 mmHg and 77% of patients (n=34) had uncontrolled hypertension. Adherence to 93 antihypertensive medications was measured and the average Medometer score was 81% (range 0-100%). Among 27 patients taking 2 or more antihypertensives, the Medometer identified 7 patients (26%) that had isolated problems with a specific medication. The remaining patients had consistent adherence patterns across all medications. In patients with controlled BP (n=10), the mean adherence score was 91%, while the mean adherence score was 76% in those with uncontrolled BP (n=34). Adherence counseling was performed in all nonadherent patients. Drug therapy was recommended to be changed 7 times in 6 uncontrolled patients (14%) with identified barriers to adherence, and drug therapy was recommended to be continued or restarted in 11 patients (32%) not at BP goal due to nonadherence or secondary

causes for hypertension. Drug therapy was also recommended to be adjusted 16 times in 15 patients (44%) with uncontrolled BP.

Conclusion: The Medometer adherence tool is useful in measuring adherence to antihypertensive medications. Use of this tool can provide pharmacists with important information for collaborating with physicians to improve medication adherence, identify drug therapy problems, and potentially improve BP control. Further study is needed to determine the effect on clinical outcomes.

4-011

Category: Ambulatory Care

Title: Evaluation of a pharmacist-managed, physician-supervised tobacco cessation clinic in outpatients of an academic heart hospital

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Purpose: The objective of this study was to describe the practice model, clinical interventions and impact of a physician-supervised, pharmacist-run tobacco cessation clinic utilizing a unique practice model of specialty practice pharmacists and pharmacy trainees within the ambulatory care clinic of an academic medical center heart hospital.

Methods: A retrospective chart review was conducted on patients within a pharmacist-managed tobacco cessation clinic held one half-day weekly, in an academic medical center heart hospital under the umbrella of preventive cardiology, between January 1, 2014 and December 31, 2014. Appointments were conducted in collaboration by pharmacy students, pharmacy residents, a pharmacy specialist, and cardiologist. Encounters were assessed for clinical interventions and impact including: referral base, number and type of visits, description of changes in tobacco usage, percentage setting quit date, and quit method utilized.

Results: In 2014, the clinic established 65 patients and conducted 174 visits. The service was utilized by 18 different departments, including general cardiology, heart failure, electrophysiology, cardiothoracic surgery, general surgery, endocrinology, pulmonary, and oncology, with 49.2% of referrals from a cardiology-based subspecialty. The average number of cigarettes at initial visit was 17.2, with average of 9.2 at study end. Quit methods varied with utilization including nicotine replacement (NRT) monotherapy for 40% (n=26), varenicline monotherapy for 20% (n= 13), buproprion monotherapy for 9 % (n=6), behavior modification monotherapy for 20% (n=13), and dual medication therapy for 11% (n=7). At study conclusion, NRT monotherapy was utilized for 25% (n=16), varenicline monotherapy for 15% (n=9), buproprion monotherapy for 5% (n=3), behavior modification monotherapy for 12% (n=8), dual medication therapy for 8% (n=5), with 50% (n=33) of patients lost to follow-up. A quit date was set by 94% (n=61) of patients. Quit rate was 21.5% (n=14) by the end of 2014 regardless of initial visit date.

Conclusion: This study demonstrated that for patients in a pharmacist-managed tobacco cessation service within an academic medical center heart hospital, tobacco cessation was

achieved in a high proportion of patients. A variety of quit methods were utilized, including both pharmacologic and non-pharmacologic. This ongoing clinic demonstrates a successful model for incorporating pharmacists, pharmacy residents, and pharmacy students into a tobacco cessation clinic.

4-012

Category: Ambulatory Care

Title: Team-based approach to Medicare annual wellness visits within a federally qualified health center

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Purpose: Medicare Annual Wellness Visits (AWV) are an important new opportunity for primary care practitioners to provide patient-centered preventive care. Unfortunately, this beneficial service is largely underutilized due to significant time requirements. As a result, pharmacists in ambulatory care settings are increasingly being utilized to conduct AWVs in an effort to improve access. However, since current Federally Qualified Health Center (FQHC) rules do not recognize pharmacists as practitioners, AWV implementation remains a challenge among underserved populations. The purpose of this project was to determine the feasibility of utilizing a dedicated clinic day to provide team-based AWVs at a single FQHC clinic.

Methods: Eligible Medicare patients were identified and notified of the upcoming AWV clinic day. Three of the four clinic teams participated in the planning and implementation of the service. Teams were comprised of primary care practitioners (PCP), medical assistants (MA), registered nurses (RN), care coordinators, clinical pharmacists and pharmacy students, who each had assigned roles during the patient visit. Screening assessments and functional evaluations were performed by the MAs and RNs, medication reviews were conducted by the clinical pharmacy team, and the PCP completed all documentation and performed a final check-in with the patient. Based on assessment findings, the care coordinators facilitated referrals for recommended services such as home safety evaluations, hearing assessments, and nutrition support. Medication reviews were used to identify medication-related problems, evaluate the appropriateness of therapy, and recommend referrals for ongoing chronic disease state management under existing collaborative practice agreements.

Results: Sixty-seven of the eligible Medicare patients invited to attend the AWV clinic day were scheduled, of whom 53 arrived and completed an appointment. This resulted in an average of 17 AWVs per team. Medication reviews performed by the clinical pharmacy team led to the identification of 99 medication-related problems and 8 referrals for ongoing chronic disease state management. The most commonly identified medication-related problems were in regards to suboptimal treatment based on current guidelines, untreated medical problems, and poor medication adherence. Additionally, seventeen community agencies participated in the event to provide information and education regarding available community health resources, patient assistance programs, immunizations, and advanced care directives.

Conclusion: We successfully implemented a dedicated clinic day to provide Medicare Annual Wellness Visits at our single clinic site. Given current legislative restrictions and practitioner time constraints, a team-based approach to conducting AWVs could allow for more primary care practitioners, particularly within FQHCs, to provide this valuable service, while affording the clinical pharmacy team focused time to identify and resolve medication-related problems.

4-013

Category: Ambulatory Care

Title: Role of pharmacists in facilitating administration of alemtuzumab in patients with multiple sclerosis

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Purpose: In the US, alemtuzumab received approval for treatment of relapsing forms of multiple sclerosis (MS) in November 2014. In phase 3 trials in patients with relapsing-remitting MS, alemtuzumab demonstrated greater improvements in efficacy outcomes versus subcutaneous interferon beta-1a over 2 years, with manageable safety; efficacy was durable over 4 years. In clinical trials, alemtuzumab 12 mg was administered as 2 annual courses on 5 consecutive days at baseline and on 3 consecutive days 12 months later. This project examined the role of pharmacists in implementing alemtuzumab administration for treatment of relapsing forms of MS in a large hospital clinic.

Methods: This project was undertaken in the Center for Neurological Disorders at Wheaton Franciscan Healthcare- St Francis, Milwaukee, WI. Addition to the institution's formulary was requested by the medical director through the Pharmacy and Therapeutics Committee. The pharmacist participated as an integral team member to assist in the formulary request process as well as being an active part of a multidisciplinary group within the center. The multidisciplinary group consisted of the following: medical director, physician assistants, financial counselor, infusion registered nurse(RN),and pharmacist. Together, this group developed the processes for successful implementation of alemtuzumab infusions for patients with MS.

Results: The pharmacist reviewed the available literature on alemtuzumab and was educated and trained on the alemtuzumab Risk Evaluation and Mitigation Strategy(REMS)program. This allowed the pharmacist to work more effectively with the providers(medical director and physician assistants)for a successful request for addition to formulary. Development of an educational inservice was prepared for emergency room providers who may encounter patients who have received alemtuzumab. Discussion with the providers to develop the medication portion of the orderset for administration and potential infusion reaction management occurred. A tracking form was created to summarize key logistical points for administration of the initial 2 alemtuzumab courses, and an additional form for further courses if needed. Processes were established for obtaining alemtuzumab from the manufacturer, drug preparation, and returning drug. Training programs were developed for staff pharmacists and technicians who routinely work with the center to increase familiarity with alemtuzumab infusions. Collaboration with the infusion RN and financial counselor occurred to create a smooth process for enrolling,

scheduling, obtaining, and administering drug for each patient. Additionally, the pharmacist discussed potential infusion-related side effects and management with the patient, beginning on the first infusion day, with daily discussions on the remaining infusion days.

Conclusion: With the establishment of processes and staff training, pharmacists in a hospital setting can collaborate effectively with other center healthcare providers, thus playing a crucial role as part of a multidisciplinary team working towards optimal outcomes in the use of alemtuzumab treatment for patients with relapsing forms of MS.

4-014

Category: Ambulatory Care

Title: Efficacy of controlling blood pressure in patients taking metoprolol tartrate once daily in three federally qualified community health centers

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Purpose: Our primary goal was to identify patients with an active prescription for metoprolol tartrate (MT) once or twice daily and assess blood pressure (BP) control using current guidelines. Clinical pharmacists worked with primary care providers (PCP) to switch uncontrolled patients to metoprolol succinate (MS) once daily for improved BP control.

Methods: A query of the electronic medical records (EMR) identified 207 patients with an active prescription for a beta-blocker who were seen in clinic between March 1, 2013, and February 28, 2014. Patients were evaluated based on diagnosis of hypertension and the most recent recorded BP measurement in the EMR. BP goal was defined as <140/90 per the Eighth Joint National Committee (JNC8) if patient did not have diabetes mellitus (DM) and <140/80 per the 2014 American Diabetes Association (ADA) if patient did have DM. PCPs were provided a list of patients who may benefit from switching to MS and a repeat review was conducted 2 months later.

Results: Of the 51 patients taking MT once daily, 47% were uncontrolled. At the second review, 40% had been seen by their PCP and all but one had uncontrolled BP at the time of visit. However, only one MT to MS change was made. Of the 156 patients taking MT twice daily, 39.7% were uncontrolled. At the second review, 36% had been seen and 57% were uncontrolled at the time of the visit, and only 3 patients were switched from MT to MS.

Conclusion: Once daily dosing of MT may result in uncontrolled BP due to its short half-life. Although not assessed, poor adherence may be a reason for uncontrolled BP in patients taking MT twice daily. The vast majority of recommendations were not implemented by PCPs. We suspect low implementation is a result of inadequate communication of recommendations rather than PCP resistance. Identifying strategies to improve pharmacist-PCP communication of drug therapy recommendations at the federally qualified community health centers can increase acceptance rate and improve overall patient care.

4-015

Category: Ambulatory Care

Title: Evaluation of a patient education initiative on medication reconciliation

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Purpose: Medication reconciliation is recognized as a proven methodology to reduce medication adverse events. In ambulatory care, it is reported that 50-75 percent of visits result in a prescription, however, 75-87 percent of charts have inaccurate medication lists. This lack of medication reconciliation is linked to 46 percent of medication errors, 20 percent of adverse drug events, and 27 percent of prescribing errors in hospitalized patients. Because sources cite the need for patient involvement to improve medication list accuracy, our clinic spearheaded a patient education initiative. In this study we propose to evaluate the effect of patient education on medication reconciliation.

Methods: The educational program ("Safe Meds") was initiated in a specific population of a volunteer clinic. Patients qualified for inclusion in the program if they had at least 5 prescribed medications and were a current patient of the volunteer clinic's chronic care clinic. Once a patient was identified they received patient education materials, a medication bag, and medication wallet cards. They were instructed to bring all medications (both prescription and over-the-counter) with them to their next (and all subsequent) visit(s) and encouraged to review them with their provider. The assumption was that patients who were educated on the importance of an accurate medication list would be more motivated to remind the provider to update their list. When the patient returned for their next (and all subsequent) visit(s) a medication history was conducted, it was documented if the patient brought in their medications, and inaccuracies in the medication list were identified. The primary outcome identified was change in patient participation (did they bring their medications to their office visit) and secondary outcomes were number and type of inaccuracies identified through the medication history.

Results: Prior to implementation of the "Safe Meds" program, patients did not bring their medications with them to their appointments and a majority of the medication lists were inaccurate. A total of 40 patients were enrolled in the Safe Meds program over the course of the year and participation was assessed at 58 appointments. Patients brought in their medications for review at 28 percent of subsequent appointments ($p < 0.001$). Discrepancies were found at 55 percent of appointments for patients who did not bring in their medications and at 75 percent of appointments for patients who did bring in their medications ($p=0.16$). The average number of discrepancies found were 1.4 for patients who brought in their medications and 1.0 for patients who did not ($p=0.25$). The most common discrepancy found was that a medication needed to be added to the list (62 percent of all discrepancies found).

Conclusion: While not a large increase, the minimal effort of this educational intervention significantly increased patient participation in the medication reconciliation process. While not a statistically significant difference, more discrepancies were found when patients brought in their

medications as opposed to when they did not, suggesting that bringing in medications could result in more accurate lists. Most of the discrepancies found were medications missing from the list, which providers would have been unaware of during medical decision making. Overall, the educational program gave a small but clinically relevant increase in patient participation in medication reconciliation.

4-016

Category: Ambulatory Care

Title: Implementation of Medication Therapy Management Program in Established Disease Management Clinics

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Purpose: The Comprehensive Medication Review (CMR) has become an important tool for pharmacists to use to provide better care for patients. Utilization of these reviews allows pharmacists to have positive interactions with patients and providers. This project was designed to evaluate the rate of acceptance of recommendations made by the pharmacist following a CMR and to evaluate the revenue these generated.

Methods: Over a period of 12 months, medication reviews were completed for patients scheduled to see the pharmacist at an established ambulatory care clinic. Patients were asked to bring in all of their medications to the visit. The patients medication list, laboratory values, vitals and allergies were reviewed. At the end of the visit, patients were given a list of current medications along with any instructions generated by the CMR. By utilizing currently available software, recommendations were made to the prescribing provider. Once these recommendations were accepted or refused, the patient was contacted by the pharmacist. Each intervention was also billed to the patients third party insurance. Revenue from these interactions was also tracked.

Results: Fourteen medication reviews were completed during the time period. Each intervention took approximately 30 minutes. Sixteen problems were identified during the process with fourteen interventions being submitted for prescriber review. Thirteen interventions (93%) were accepted. The most common intervention submitted was adherence altered. One each of the following interventions was also made: decreased dose, immunization, new/change prescription medication, and new/change over the counter medication. These interventions brought $866 dollars in revenue to the clinic. The range of reimbursement for intervention ranged from a low of $2 to a high of $75.

Conclusion: Pharmacist completed medication reviews can serve as a source of revenue for an established outpatient ambulatory clinic. These interventions also help build stronger relationships that will benefit both patients and providers alike.

4-017

Category: Ambulatory Care

Title: Medication therapy management (MTM) intervention in an outpatient orthopedic surgery center: Three years later.

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Purpose: Adverse drug events (ADE) negatively impact health care delivery in the outpatient setting. One way to potentially reduce ADEs is to take the outpatient surgery event as an opportunity to evaluate a patient medication regime for appropriateness by a pharmacist. The patient in this setting also needs to be evaluated for pain control and deep venous thrombosis (DVT) prophylaxis, which may result in new medications, a pharmacist can help manage this. This is a description of what this MTM intervention entails and strengths and opportunities in this MTM intervention.

Methods: A patient is referred to a surgeon for evaluation for surgery due structural damage and is recommended for surgery. Nursing obtains a medication history, health history, and evaluates the patient for DVT prophylaxis using phone, mail, and electronic communication with the patient and other healthcare workers involved with the patient. The pharmacist use this information to access the patients medication regime for appropriateness. New medications are started and the pharmacist uses verbal or written information to communicate with the patient, nursing, or doctors any issues or recommendations. The chart is reviewed for duplications in therapy, medication dose, allergies that may affect medication additions, disease state omissions of therapy, and how to take new medication additions. An electronic drug interaction data base is used to identify interactions that may take place between current medications and medications that may be added.

Results: The pharmacists has up to date information on a patient and can review the medication regime using a health history and other inpatient and outpatient records that are obtained by nursing. If there is a potential error in the incoming medication regime the primary care physician (PCP) or patient are contacted to rectify the issue. Medical staff at the surgery center and the patient are made aware of drug interactions, disease state-drug interactions, and drug-allergy interactions that can take place with medications specific to the patient treatments at the time of surgery or after the surgery. The drug interactions most commonly encountered are DVT prophylaxis interaction, an example would be aspirin and other NSAIDs reducing aspirin's DVT prophylaxis effectiveness. Drug interactions that increase the risk of sedation, serotonin syndrome, bleeding, and paralytic ileus are commonly encountered also.

Conclusion: This MTM interventions allows pharmacist access to clinical summaries for outpatients. Viswanathan et al. reported clinical trials with clinical summaries for MTMs show a reduction in ADEs but most outpatient trials do not have summaries. A clinical summary gives one the opportunity to look for errors of omission but it is hard to tell if a disease state it not

being treated due to it being subclinical or it is actually an error. Lo et al reported errors of commission and omission are the most common errors that lead to clinical risk.

4-018

Category: Ambulatory Care

Title: Integration of clinical pharmacy services into a patient-centered medical home using National Committee for Quality Assurance standards

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Purpose: The patient-centered medical home (PCMH) is a care delivery model designed to improve the quality, effectiveness and efficiency of care. The National Committee for Quality Assurance (NCQA) offers a PCMH recognition program with standards that the practice must meet, such as working in teams and coordinating and tracking care over time. If a practice achieves NCQAs PCMH recognition, they can take advantage of financial incentive payments and may qualify for additional bonuses. The purpose of this initiative was to expand clinical services at a community hospital into the ambulatory setting through integration of a pharmacist into the hospital's PCMH.

Methods: The pharmacist met regularly with key stakeholders as well as with the entire PCMH team (both clinical and non-clinical staff) to discuss required elements and unmet needs for certification. Once it was determined which elements and factors would be met by providing ambulatory clinical services, the pharmacy was able to justify the need for provision of ambulatory services and receive the support and resources necessary to integrate a pharmacist into the PCHM several months prior to the practice submitting for NCQA certification. Processes were created to allow the pharmacist to identify patients and provide the services necessary to meet the specific certification standards selected.

Results: Several areas were identified where provision of pharmacy services would ensure that elements required for PCMH certification and recertification would be met. The areas identified included standards related to patient centered access (by integrating a pharmacist into group visits), population health management (by addressing medication overuse and appropriate issues and providing medication monitoring for specific medications) and performance measurement and quality improvement (by identifying and tracking outcomes for specific patient populations). This allowed for the integration of pharmacy services into the ambulatory care setting with full support of the PCMH team as well as hospital administration. In addition, since pharmacist services in the PCMH were unable to be billed for at the practice site, linking pharmacist services to required PCMH elements and standards provided a way for the department of pharmacy to justify providing ambulatory services and expand into the outpatient setting.

Conclusion: Clinical pharmacy services have much to offer for PCMHs seeking NCQA recognition. Several standards and elements required for recognition can be met by integrating a pharmacist into the PCHM. Since PCMH recognition is associated with increased funding opportunities, utilizing clinical pharmacy services to meet required standards may be a method to justify expansion of pharmacy services into the outpatient setting.

4-019

Category: Ambulatory Care

Title: Survey of community pharmacists after initiating a transitions of care quality improvement project

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Purpose: A common challenge with the implementation of a care transitions program is communication across healthcare providers, including the community pharmacist, who is responsible for the ultimate dispensing of medications to patients. Therefore, the purpose of this quality improvement initiative was to notify community pharmacists of drug therapy changes which took place during a transition of care, including new medications prescribed, medications discontinued, and medications for which dose or frequency changes were made, and survey such pharmacists regarding the value of and actions taken pursuant to receipt of this information.

Methods: Ambulatory care clinical pharmacists within the health system provide transitions of care follow-up and medication reconciliation for patients recently discharged from the hospital or skilled nursing facility (SNF) per usual care. During this quality improvement initiative, this process was modified to include communication via fax to the patients primary community pharmacy of medication therapy changes made during this care transition. The one page faxed document included a description of changes in medication therapy made upon discharge from the inpatient care facility as well as survey questions for the community pharmacist to complete and return. Community pharmacies included in this study were identified by the patient receiving the transition of care follow-up. Data for the study was obtained from survey responses completed by community pharmacists from 2/1/2015 to 6/1/2015. The institutional review board approved this quality improvement project.

Results: Of 99 faxes sent to community pharmacies to communicate 435 drug therapy changes made upon hospital discharge, 20 (20.2 percent) surveys were completed. Of the completed surveys, 85 percent were reviewed by a pharmacist, and 5 percent were reviewed by a pharmacy technician. As a result of the information provided, 55 percent of respondents deactivated drug therapy in their dispensing system, 35 percent added notes to the patient file, and 40 percent reviewed the medication changes with the patient or caregiver. Seventy-five percent felt the communication to the community pharmacy improved patient safety. On a scale of 1 (not valuable at all) to 10 (extremely valuable), when asked how valuable receiving this medication change information was, the mean response was 7.05. Across all faxes sent to community pharmacies, there was an average of 4.4 medication changes communicated per patient upon transition from the hospital or SNF to home. Of 121 medication discontinuations communicated, 61 were antihypertensives, 13 were controlled substances, 12 were non-steroidal anti-inflammatory drugs, 11 were antiplatelets or anticoagulants, 7 were narrow therapeutic index

drugs, and 4 were diabetes drugs. Qualitative data, gathered from free text comments, also provided suggestions for future program direction and improvements.

Conclusion: This pharmacist quality improvement program increased the sharing of information between ambulatory care clinical pharmacists and community pharmacists for included patients who experienced a transition of care. As a result of this communication, community pharmacist respondents made edits to patient profiles, discussed the medication changes with the patient or caregiver, and believed the program provided valuable information which improved patient safety. The results of this study will be utilized in the development of a standardized transitions of care process across the health system which will include enhanced communication with community pharmacy partners.

4-020

Category: Automation / Informatics

Title: Decreasing medication errors and improving pharmacy efficiency through the use of radiofrequency identification (RFID) tags.

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Purpose: Increasing patient safety and improving pharmacy efficiency is a constant struggle as the pharmacy department works to meet productivity and financial goals. Our pharmacy averaged two pharmacist hours per day double checking various medication kits. According to a leading vendor of radiofrequency identification tags, there is an estimated 20 percent error rate in manually filled kits, with approximately 10 percent of these errors causing an adverse drug event. A project was designed, and implemented in 2014 in an effort to decrease medication restocking errors, reduce time required of pharmacists, and ultimately save money by decreasing the amount of expired medications.

Methods: A cost benefit analysis was performed to determine if RFID technology would be a viable option for our pharmacy. The cost benefit analysis was based on a seven year tag upcharge model to determine potential net savings and return on investment. The cost for RFID technology is based on tag cost; scanning hardware and printer are maintained by the vendor. Areas where savings can be generated include: pharmacist labor, medication error cost avoidance, and a reduction of expired medications. Pharmacists would routinely catch several restocking errors a day via a manual check process. RFID technology has eliminated the pharmacist double-check process, leading to time savings that can instead be devoted to patient care activities. Pharmacy has initiated a performance improvement plan to ensure compliance with the dispatching of kits to the correct unit and procedure compliance.

Results: Cost for RFID tags at our institution is approximately 15,000 dollars per year. It is estimated in the first year, we will save 17,914 dollars in pharmacist labor which will make pharmacists available for redeployment to more clinical duties. It is expected that we should be able to reduce our cost of expired medications by 5,951 dollars in the first year. Scanning medications with RFID tags is estimated to save the pharmacy 2,430 dollars in medication error cost avoidance in the first year. This gives us a net savings of 11,295 dollars and a 75.3 percent return on investment. Based on a tag upcharge model, after seven years we can expect a net savings of 96,417 dollars, which is a 91.8 percent return on investment. To ensure compliance with dispatching kits to the correct unit, pharmacy technicians complete monthly audits of random hospital units and verify that the correct kit number is located there as listed in the system. Our performance improvement goal is to be at least 90 percent compliant with the correct kit being in the system matching the unit dispatched.

Conclusion: RFID technology has decreased medication errors in medication kits by removing the component of human error. We have greatly decreased pharmacist time by using RFID technology to double check medications in kits leading to a positive return on investment in a relatively short amount of time.

4-021

Category: Automation / Informatics

Title: Implementation of improved interdepartmental communication utilizing new technology and secured text message functionality.

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Purpose: CHI Memorial Hospital is a 360-bed facility in Chattanooga, TN. Efficient communication between the pharmacy and nursing departments has long been a challenge due to the compounded effects of the busy and bustling nature of both the pharmacy and the patient care units. Information that can contribute to patient care will often go unaddressed due to inadequate communication resulting in sub-optimal outcomes for patients and decreased job satisfaction for employees.

Methods: Pharmacists joined the hospital communications work-group with nursing directors and IT personnel to seek access to the Responder 5 communications system. Permission to this system gave the pharmacists the ability to access nursing ASCOM phone numbers and the ability to send text messages to those ASCOM phones. A policy was written specifying the intent and parameters of the program, which was to be adhered to by both departments. A 2 week pilot program in the clinical decision unit and cardiac short stay units was initiated and feedback was collected from both the nursing and pharmacy departments.

Results: Only positive feedback from both nursing and pharmacy was received by the work-group team. Nursing praised the efficiency and the minimization of interruptions. Pharmacists commented on the efficiency of texting in comparison to the traditional method of communication with nursing.

Conclusion: The utilization of the texting functionality of Responder 5 at our health system maximized efficiency and improved job satisfaction for employees.

4-022

Category: Automation / Informatics

Title: Adverse drug reaction (ADR) identification using rule-based data mining software to improve pharmacovigiliance in a community hospital: Initial pilot and results

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Purpose: The Centers for Medicare and Medicaid Services (CMS) mandates that hospitals have policies in place that define adverse drug reactions (ADRs) and programs that manage ADR tracking and reporting. The pharmacy department at our institution accomplishes this national safety requirement by using retrospective review through electronic medical record (EMR) investigation and real-time reporting through a risk alert system. Tracked ADRs are disseminated quarterly to physicians and other prescribers through the Pharmacy and Therapeutics (P&T) Committee. Recent implementation of Sentri7 real-time patient surveillance software in our institution allowed for the expansion and streamlining of our current ADR identification and documentation process.

Methods: Upon implementation of Sentri7 at our institution in October 2014, rules were created using Boolean operators and a mixture of clinical and demographic information to identify patients that have experienced specific quantifiable ADRs. Monthly reports were generated from these rules, on demand, to allow for retrospective chart review and ADR documentation upon confirmation of an event using our EMR. These monthly reports are very efficient and complete; equivalent traditional reports required a larger time commitment as they were generated automatically on a daily basis for review (International normalized ratios [INR] greater than 5, digoxin level greater than 2 ng/mL), or relied on reports generated from automated dispensing cabinets (Dextrose 50% injection and naloxone injection withdrawals). A year-over-year comparison (Q4 2013 vs. Q4 2014) was performed on the number of ADRs tracked using the previous system and the current Sentri7-based system. Time-savings during patient identification was estimated and compared using both systems. The number documented ADRs per patients identified using traditional identification methods with non-quantifiable triggers was analyzed. A one month pilot of real-time ADR tracking in Sentri7 using two decentralized pharmacists was also completed. Additionally, ADRs were grouped based on their occurrence during inpatient (IP) stay or prior-to-admission (PTA).

Results: Use of Sentri7 rules resulted in identification of more ADRs from elevated INRs and digoxin levels in Q4 2014 when compared to the same three month period in 2013 (24 vs. 13). There were 11 (4 IP, 7 PTA) patients with INR greater than 5 in Q4 2013 as compared to 14 (1

IP, 13 PTA) in the Q4 2014. The number of patients with digoxin levels greater than 2 ng/mL identified in the Q4 2013 was 2 (0 IP, 2 PTA) compared to 10 (4 IP, 6 PTA) in Q4 2014. Using reports from April 2015 for these two triggers as a benchmark, the estimated time needed to identify patients with the old system was 27 minutes/quarter vs. 2.5 minutes/quarter with Sentri7. More patients were identified with ADRs using Sentri7 (14 vs. 3) than the old system in April 2015. Rules for rescue medication triggers (Dextrose 50% and naloxone orders) did not yield evaluable data due to the identification of more than 1000 patients for review in Q4 2014. Subsequently, the old system of identification was used for this timeframe (176 patients to review). The decentralized pharmacists that piloted real-time reporting using Sentri7 documented 8 ADRs during April 2015.

Conclusion: Sentri7 software helped to streamline and modernize documentation for specific ADRs. Due to this initial pilots success, additional rules have been incorporated to capture ADRs based on drug levels (Supratherapeutic serum concentrations of vancomycin, phenytoin, gentamicin, lithium, and valproic acid). Using rules to identify ADRs without quantifiable triggers has been somewhat more problematic, but improvement to rule logic may broaden future applicability within our program. Further expansion in documentation is expected as the pharmacy staffs grasp and utilization of the software improves and the clinical team identifies creative ways to identify ADRs.

4-023

Category: Automation / Informatics

Title: The Effect of Bar-Coded Medication Administration System (BCMA) on Medication Administration Errors (MAE)

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Purpose: Bar-code-enabled medication administration (BCMA) technology has been encouraged by the American Society of Health-System Pharmacists (ASHP) to reduce Medication Administration Errors (MAEs) in hospitals. However, few studies have evaluated the effect of BCMA on MAE rates. By combining the results across these studies a more conclusive effect of BCMA on MAE can be identified. . The objectives of this study were: 1) to determine the effect of using BCMA on MAEs in the literature through a meta-analysis, and 2) to identify what types of errors were affected by BCMA

Methods: A meta-analysis was conducted on studies evaluating the effect of BCMA on MAEs. The primary literature sources were PubMed and Google Scholar by using the keywords barcode medication administration system, barcode technology, medication administration error and medication error. The inclusion criteria included: English language publications of studies of BCMA on administration process and use of observational data collection methods. A sensitivity analysis to assess the quality of the studies and a funnel plot to assess the presence publication bias were performed. Number of MAEs and number of doses prepared before and after BCMA implementation were extracted. Unit of error rates were calculated by the equation of number of errors divided by the number of doses prepared. The principal measurement for determining an effect was Odds Ratio (OR). Heterogeneity was assessed by the I2 value. Random Effect Model was used for the analysis. Meta-regression analyses were also applied to determine if using an Electronic Medication Administration Recording system (EMAR), and time between EMAR and BCMA implementation or start date of observation, were also significant factors affecting the rate on MAEs. Types of errors were categorized into either wrong medication, wrong time, wrong dosage, wrong route, unauthorized drug, omission, or unavailability.

Results: A total of 141 articles were identified. Of these, 10 studies representing 13 sample sites were included in the final analysis. The results of the sensitivity analysis showed that none of the individual 10 studies significantly affected the overall result. A random effect model was chosen due to the high heterogeneity between studies ($I2 = 82.2\%$). The overall OR was 0.57 ($p=0.0003$) which indicated reduced MAEs when using BCMA. The meta-regression results showed that neither EMAR implementation ($p=0.65$), nor the time between EMAR and BCMA implementation or start date of observation ($p=0.68$), were significant factors affecting the rate of MAEs. When analyzing the effect of BCMA on types of MAEs, there were(1) a significant

decrease in omission (OR=0.48, p=0.054), (2) a potential decrease in wrong dosage (OR=0.73, p=0.066), (3) a significant increase in wrong route errors (OR=4.2, p=0.029), and (4) a potential increase in wrong time (OR= 2.0; p=0.071).. BCMA appeared to have no effect on wrong medication (OR=0.77; p=0.51), unauthorized drug (OR= 0.82, p=0.49) or unavailability errors (OR= 1.3, p=0.67).

Conclusion: BCMA technology can significantly decrease MAEs, especially omission errors. This technology can also potentially reduce wrong medication and wrong dosage. However, BCMA technology may also increase wrong route errors and potentially increase wrong time errors. Future studies should investigate ways to further improve BCMA technology by reducing specific types of errors identified and why it may increase certain types of errors

4-024

Category: Cardiology / Anticoagulation

Title: Assessment of discharge oral anticoagulation therapy tolerance, adherence and cost at a specialty heart hospital

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Purpose: Oral anticoagulation is commonly used for the prevention of thromboembolic events in patients with atrial fibrillation (AF), mechanical valves, and for prevention and treatment of venous thromboembolism (VTE). As more new oral anticoagulants (NOACs) are FDA-approved and indications expand, providers are challenged with optimal product selection. Furthermore, there are limited comparative data regarding the cost, adherence, and tolerability of these agents. Therefore, this study was conducted to compare the initial tolerance, adherence and cost of the NOACs. A secondary objective was to assess for correlations between anticoagulation choice and patient characteristics.

Methods: This study was reviewed and approved by the Creighton University IRB. From September 2014-March 2015, 93 patients were discharged from the Nebraska Heart Hospital with a new prescription for an oral anticoagulant for any indication (70 (75%) NOAC and 23 (25%) warfarin). All patients prescribed a NOAC were contacted by a pharmacist within two weeks of discharge. If patients had difficulty obtaining or tolerating their prescription, therapy was modified. Patients were categorized as early non-adherent if they never filled or self-discontinued the NOAC during this time. Patients were categorized as intolerant if the NOAC was discontinued or switched to a different agent due to side effects. Other data collected from all patients included age, gender, race, height, weight, drug type, dose, indication, CHA2DS2-Vasc score, HAS-BLED score, concomitant illnesses, concomitant medications, alcohol and drugs of abuse, insurance type, side-effects, need for patient assistance, and co-pay. Student t tests were used to compare differences between the NOAC and warfarin group. ANOVA was used to compare differences between the three NOAC groups. A p value less than 0.05 was considered statistically significant.

Results: Of the 70 NOAC patients, 25 (36%) were apixaban, 4 (6%) dabigatran, and 41 (58%) rivaroxaban. Of the 51 NOAC patients reached, only 2 on rivaroxaban were intolerant ($p>0.05$) secondary to bleeding. In this same cohort, 2 (11%) of apixaban, 0 dabigatran, and 4 (13%) of rivaroxaban patients were non-adherent ($p>0.05$) due to cost, side effects, or lack of awareness that a new medication was prescribed. While there were no significant differences in the mean cost between the three NOACs, 1 apixaban patient and 4 rivaroxaban patients paid $200-$400 per prescription. When comparing NOACs versus warfarin, there were no significant differences

between gender, race, weight, insurance, or concomitant antiplatelet agents. There were no significant differences in the presence of concomitant illness with the exception of renal disease (18 (26%) NOAC versus 11(48%) warfarin, p=0.047). There was a trend towards increased age in the NOAC group (76.0+/-10.9 versus 69.7+/-19.6 years, p=0.060). As expected, patient costs were significantly lower for warfarin and the indication of mechanical valve was higher (4 (6%) versus 6 (26%), p=0.013). Of the AF patients, mean CHA2DS2-Vasc scores were 4.0+/-1.6 and 4.6+/-2.0, p=0.270 and mean HAS-BLED scores were 2.6+/-1.1 and 2.3+/-0.7, p=0.330, NOAC versus warfarin, respectively.

Conclusion: At this institution, where NOACs comprise 75% of new anticoagulation prescriptions, NOACs were generally well-tolerated. Non-adherence was >10% for the two most commonly prescribed, apixaban and rivaroxaban. As per recent guidelines, patients with renal dysfunction were more likely to be prescribed warfarin as were those with a mechanical valve indication. Larger multi-site cohorts are needed to confirm trends seen with age and CHA2DS2-Vasc scores. Early pharmacist intervention was useful in identifying patients that were early non-adherent or intolerant, needed additional education, financial assistance, or required a change in therapy.

4-025

Category: Cardiology / Anticoagulation

Title: Comparison of pharmacist-managed warfarin dosing program with physician prescribed warfarin management practices in achieving therapeutic international normalized ratios (INRs) in a 120 bed rehabilitation hospital

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Purpose: Due to the pharmacodynamic properties of warfarin administration, careful monitoring is essential in achieving therapeutic international normalized ratio (INR) target levels while minimizing associated potential bleeding complications. The primary endpoint of this study is to evaluate the effectiveness of an inpatient pharmacist-managed warfarin dosing program in comparison with traditional prescriber ordered warfarin dosing practices to see if there could be a realized improvement in patients achieving more consistent therapeutic INR target levels. In addition, a secondary endpoint was to reduce the overall number of ordered protime/INR laboratory tests for a potential cost savings.

Methods: Based on current clinical guidelines and evidence-based medicine, three different INR therapeutic range warfarin dosing algorithms were developed and evaluated before final approval and implementation into the pharmacist-managed warfarin dosing program. Although Spaulding Hospital for Continuing Medical Care North Shore does not have an institutional review board, the establishment of the pharmacist-managed warfarin program was vetted and approved by the Pharmacy and Therapeutics Committee, Patient Care Services, the Medical Executive Committee, and Partners HealthCare Legal Counsel. The first warfarin dosing algorithm established an INR target range of 1.7-2.5, while the second had an INR target range of 2-3, and the third had an INR target range of 2.5-3.5. When a prescriber electively decided on using the pharmacist-managed warfarin dosing service, he/she would then select the appropriate initial warfarin dose and desired INR target range algorithm before handing daily warfarin dosing responsibilities over to the pharmacy staff. Based on the pharmacist-managed warfarin algorithm program, the pharmacy staff would then determine subsequent warfarin doses as well as ordering appropriate PT/INR laboratory tests. At any time, the prescriber could discontinue the pharmacist-managed warfarin algorithm program and change back to determining daily warfarin doses on his/her own.

Results: Over an eight month period, prescriber management of warfarin dosing was compared with the pharmacist-managed warfarin dosing program. During this time, the pharmacist-managed program resulted in an average of 94.4 percent of patients being in therapeutic INR range while prescribers achieved an average of 84.9 percent. In addition, the pharmacist-managed program resulted in fewer incidences of both subtherapeutic (2.3 percent vs. 11.3 percent) and supratherapeutic (3.3 percent vs. 3.9 percent) INR levels than prescriber warfarin

management practices. Also, the pharmacist-managed warfarin dosing program resulted in a monthly average cost savings of 1,400 dollars as a result of an average reduction of 24.8 percent in the number of protime/INR laboratory tests being ordered in comparison with the number of protime/INR tests ordered by prescribers.

Conclusion: Based on the results of this study, the pharmacist-managed warfarin algorithm protocol demonstrated to be more effective in achieving consistent therapeutic INRs than prescriber management as well as leading to an overall reduction in the number of protime/INR laboratory tests resulting in a cost savings. In addition, the pharmacist-managed warfarin algorithm protocol showed consistency in ordering the same individualized warfarin dose for a given patient regardless of which pharmacist staff member followed the protocol. Feedback has been very positive among the Spaulding Hospital for Continuing Medical Care North Shore's prescribers for the option of pharmacists managing their patients' warfarin administration.

4-026

Category: Cardiology / Anticoagulation

Title: Experience with four-factor prothrombin complex concentrate to manage oral anticoagulant related bleeds at an academic tertiary care center

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Purpose: Four-factor prothrombin complex concentrate (PCC) has been FDA approved for the reversal of vitamin K antagonists in acute major bleeding or need for urgent invasive procedure. Currently, there is no reversal agent available for the oral factor IIa or Xa inhibitors. Our institution incorporated PCC as a last line option in the protocol for management of life threatening hemorrhage. The purpose of this review is to describe our experience with PCC for the management of oral anticoagulant related bleeds at a 600-bed, level-2 trauma, academic tertiary care center.

Methods: PCC was added to formulary in May 2014 for the management of vitamin K antagonist related bleeds or emergent INR reversal. Following extensive literature review, PCC was also included as a last line option in the protocol for anticoagulation reversal in life threatening hemorrhage for rivaroxaban, apixaban, and dabigatran if refractory to supportive care with blood products. Due to literature limited to animal models and healthy volunteers without outcomes data, lack of standardized dosing for an unapproved indication, and potential thrombogenic risk, PCC was only considered as salvage therapy for such patients. All patients ordered a dose of PCC between May 2014 and January 2015 were reviewed for appropriateness of use according to the institution protocol. Information collected included anticoagulant and antiplatelet medication, serum creatinine, age, indication, type of bleed, INR value, PCC dose administered, supportive care administered, and outcomes data including survival to hospital discharge.

Results: A total of 30 patients were ordered a dose of PCC, of which 26 were administered. The average age was 75.4 and 63 percent of patients were male. Warfarin was implicated in 15 of the bleeds, dabigatran 2, rivaroxaban 8, and apixaban 5; 5 patients had dual therapy and two had triple therapy. Average presenting INR on warfarin was 3.79. There were 8 spontaneous intracranial bleeds, 6 gastrointestinal bleeds, and 16 traumatic bleeds. Twenty patients survived and 10 expired with an overall total length of stay of 10 days. Three out of 15 warfarin patients received PCC doses over the recommended maximum for their INR. One patient on dabigatran and one patient on apixaban each received the maximum dose of 5000 units. Nearly half of the patients reviewed were determined potentially inappropriate due to non-life threatening bleeds. No patients were reported to have thrombogenic adverse effects.

Conclusion: Given the potential thrombogenic risk associated with PCC, lack of data on its use in reversal of direct thrombin and factor Xa inhibitors, and substantial cost, the institution protocol should be followed very closely to ensure use only in refractory life threatening hemorrhage.

4-027

Category: Cardiology / Anticoagulation

Title: Impact of spironolactone on hospital admission and length of stay for patients with heart failure with reduced ejection fraction.

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Purpose: With growing scrutiny on quality of care metrics linked to value based purchasing, research investigating the impact that appropriate drug therapy has on readmission rates and length of stay can play an important role in improving patient care while reducing costs. In the case of heart failure with reduced ejection fraction, spironolactone remains an underutilized agent despite its known mortality benefit. The purpose of this study was to evaluate the impact of spironolactone on hospitalization rates for heart failure with reduced ejection fraction and length of stay in order to identify additional benefits to help support appropriate medication use.

Methods: Inpatient records for any persons admitted to a University Hospitals health center since 2013 were collected based on the presence of a coded diagnosis for heart failure with reduced ejection fraction. Patients were excluded if they did not have any admissions within the stated window, if they were 90 years of age or greater, or did not have an ejection fraction on record < 50%. Data obtained from patient records included total number of admissions since the initial encounter, total number of admissions due to heart failure, length of stay for each heart failure admission, initial ejection fraction, current heart failure medication regimen, renal function, and select demographic information. Patient records were separated into two groups based on the presence of spironolactone. Total readmissions and heart failure readmissions per patient year were calculated for each patient record. Logarithmic transformation was utilized to enable the use of a student's t-test when evaluating readmissions per patient year and length of stay data. Chi squared and fisher's exact tests were performed as appropriate.

Results: A total of 84 patients met criteria with at least one inpatient visit from 2013 or later. The mean time frame from study inclusion was 13 months. Readmissions per patient year among treated and untreated patients were 2.86 vs 0.96 ($p<0.001$) for any cause and 1.23 vs 0.41 ($p<0.001$) for heart failure admissions respectively. While length of stay was shorter in the spironolactone group (5.78 vs 4.86 days) the results were not statistically significant ($p=0.33$). Although patients receiving spironolactone were younger (67.7 vs 73.5 years, $p= 0.04$). No statistically significant differences between groups comparing weight, mean MDRD, initial ejection fraction, medication use, time frame since initial encounter, cardiovascular medical history, or length of stay were identified (all $p > 0.05$).

Conclusion: Overall, the results show that spironolactone remains an underutilized medication in the treatment of heart failure with reduced ejection fraction despite additional benefits in

reduced hospital admissions. Further study evaluating the impact of spironolactone on length of stay for heart failure admissions could provide additional strength to support greater utilization of spironolactone therapy.

4-028

Category: Cardiology / Anticoagulation

Title: Describing the role of pharmacy in a multidisciplinary care pathway to improve care in heart failure patients at high risk for 30-day all cause readmission

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Purpose: Reducing the readmission rates for heart failure patients is vital in providing best patient care, reducing healthcare costs and improving reimbursement rates. An internally developed multidisciplinary care pathway for heart failure patients at high risk for 30-day all cause readmission was put into practice and assessed. We will focus on the pharmacy process that was implemented and evaluated.

Methods: A multidisciplinary care pathway was created involving pharmacists, nurses, dieticians, cardiac rehab, and care management. Heart failure patients were identified as being high risk for readmission based on a previously validated readmission predictive model, the Inpatient Heart Failure 30-day Readmission Risk Score. Once a patient was identified as being high risk, the pharmacist would complete an accurate medication reconciliation, educate on heart failure medications, and discuss core measures with the patient. During this discussion the pharmacist would identify barriers to medication compliance and refer patients to an assistance program when applicable. If the patient qualified and agreed, the hospitals outpatient pharmacy would deliver the patients new medications in an attempt to eliminate the barriers identified. Once discharge orders were written the pharmacist would educate on all new medications stressing the importance of compliance and proper use. The discharging pharmacist would conduct a follow-up phone call within 72 hours of discharge once again stressing the importance of proper use of medications, identify any potential medication problems, and answer any remaining questions. All pharmacists that were eligible to work on that unit were educated on the process. This study was approved by the local Institutional Review Board.

Results: After implementation of the pathway fifty patients were evaluated. Twenty-four pharmacists were educated on the process and verbalized understanding. Ninety-four percent of patients had a medication reconciliation completed by a pharmacist within twenty-four hours of being categorized as high risk. One hundred percent of patients received inpatient heart failure medication teaching supplemented with handouts to take home. The hospitals outpatient pharmacy filled eighteen percent of patients new medications that were started upon discharge. Pharmacy was successful in completing a follow-up phone call in forty-six percent of patients within 72 hours. Follow-up phone calls were not done in thirty-two percent of patients due to the

patients being discharged to a skilled nursing facility. Data was collected via an excel spreadsheet to accurately assess if all steps in the pathway were completed.

Conclusion: Pharmacists can play an important role in educating patients on their heart failure medications and may help to improve medication compliance. Using a structured multidisciplinary care pathway allowed for increased pharmacist involvement in the care of heart failure patients at high risk of 30-day all cause readmission.

4-029

Category: Cardiology / Anticoagulation

Title: Glucose control post cardiac surgery: a comparison of two intensive insulin infusion protocols

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Purpose: Cardiac surgery centers routinely manage postoperative hyperglycemia with continuous intravenous insulin, but protocols between institutions differ in their blood glucose targets due to goals that are institution-specific, quality institution- and government-mandated (Surgical Care Improvement Project-SCIP) and/or consensus guideline-recommended (American Heart Association, Society of Thoracic Surgery). The benefit of good glycemic control must be balanced with the risk of hypoglycemia and evidence that outcomes are not optimized with too-strict control. The purpose of this study was to evaluate glycemic control with a new insulin infusion protocol compared to the previous one. The new protocol reflected current guidelines and recommendations.

Methods: The study underwent approval by the hospitals Institutional Review Board. This retrospective chart review evaluated patients that had undergone cardiac surgery and placed on a continuous insulin infusion for at least 24 hours after surgery. Two groups were developed for comparison; one group utilizing the previous insulin infusion protocol and the second group utilizing the revised protocol. The primary differences between the protocols were the goal range (90-110 mg/dL for the old protocol and 120-150 mg/dL for the new protocol) and the use of a carbohydrate scale to cover carbohydrate intake while on the insulin infusion (new protocol). Baseline data was collected in both groups, including hemoglobin A1C, home diabetes regimen (if applicable) and type of surgery. Data was also collected on blood glucose control on the insulin infusion and subsequent rates of goal, hypoglycemia (defined as less than 70 mg/dL) and hyperglycemia (defined as greater than 180 mg/dL). Compliance with SCIP measures was evaluated. Finally, several pre-specified subgroup analyses were performed, including an evaluation of the impact on both protocols of type of surgery, baseline diabetes status and hemoglobin A1C, home insulin use and carbohydrate intake while on the insulin infusion.

Results: One hundred and fifty three patients (77 on the old protocol and 76 on the new) were evaluated in the study. The groups were well-matched at baseline. The old protocol achieved its goal range for 32 percent of blood glucose readings vs 40 percent for the new protocol (p less than 0.001). The hyperglycemia rate was 5.7 percent for the old protocol and 6.7 percent in the new protocol (p=0.19). Hypoglycemia rates were very low and were not different between groups (old protocol 0.34 percent vs new protocol 0.54 percent, p=0.33). Compliance with SCIP measures was very high for both protocols, ranging from 94 to 100 percent for the duration of the study period. The subgroup analyses revealed less hyperglycemia with the new protocol in the

following populations: baseline hemoglobin A1C 6.5-8 percent, on home insulin and carbohydrate intake while on the insulin infusion (p less than 0.001, p=0.03, p=0.02, respectively). Secondary analyses also revealed less hypoglycemia with the new protocol in the following populations: baseline hemoglobin A1C greater than 8 percent, on home insulin and cardiac valve replacement surgery. There were populations that also demonstrated improved efficacy and safety with the old protocol, primarily insulin-sensitive patients.

Conclusion: The new protocol demonstrated better achievement of target glycemic goals as compared to the old protocol. Rates of hyperglycemia were similar between the groups, despite the higher goal range for the new protocol. Surprisingly, hypoglycemia rates were also similar and very low overall. There are certain patient characteristics that predicted better glycemic control on the new protocol. The same was found to be true for the old protocol. This may allow for the customization of the insulin infusion protocol to patient-specific factors to optimize efficacy and safety of the insulin infusion after cardiac surgery.

4-030

Category: Cardiology / Anticoagulation

Title: Evaluation of the safety of antiplatelet therapy in combination with warfarin or novel oral anticoagulant after percutaneous coronary intervention

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Purpose: There are limited studies analyzing antiplatelet therapy in patients requiring long term anticoagulation after coronary stenting. In addition, novel oral anticoagulants have not been assessed in this setting. Due to the introduction of newer, more potent antithrombotic agents, the uncertainty of which combination will produce the greatest antithrombotic effect with the safest profile needs to be investigated. The purpose of this study is to evaluate the safety and efficacy of combination antiplatelet and anticoagulant therapy in those with indications for long term anticoagulation after percutaneous coronary intervention.

Methods: A single center, IRB approved, retrospective study was conducted at St. Vincents Medical Center Riverside on adult patients being followed by St. Vincents Cardiology who received coronary stenting between January 1st 2012 and December 31st 2014. Patients were identified using charge codes for percutaneous coronary intervention and medications were examined on the date of discharge to ensure patients were prescribed at least one antiplatelet and one anticoagulant medication. Patient charts were reviewed and data was collected via the electronic medical record system and paper charts at St. Vincents Cardiology. The primary outcome was composite bleeding events. Bleeding events were defined by the International Society of Thrombosis and Haemostasis criteria for major and minor bleeds. Secondary outcomes included composite thrombotic events as well as rate of hospital readmission and outpatient clinic visits. Sample size calculations were extracted from prior studies. For 80% power and an alpha level set at 0.05, 100 patients in the warfarin arm and 100 patients in the novel oral anticoagulant arm was needed to detect a 15% difference in bleeding. Forty three patients in the warfarin group and twenty eight patients in the novel oral anticoagulant group were included in this study.

Results: There were a total of 16 bleeding events: 13 in the warfarin group compared to 3 in the novel oral anticoagulant group. The rate of bleeding with warfarin and antiplatelet agents was not statistically different than the rate of bleeding with novel oral anticoagulant and antiplatelet agents (HR 2.97 [95% CI 0.85-10.43] p=0.06). Eleven out of the thirteen bleeds in the warfarin group occurred during the first month of therapy. In the novel oral anticoagulant group, patients experienced bleeding on month three, four, and twelve. There were no reported bleeds in patients

taking rivaroxaban or apixaban. Patients were more likely to be discharged on dual antiplatelet therapy in the warfarin group than in the novel oral anticoagulant group and all bleeding events in the warfarin group were due to triple therapy. There were no apparent trends in antiplatelet agents used that contributed towards bleeding or thrombosis risk. Most of the reported bleeding events were gastrointestinal related. There were a total of seven thrombotic events: 3 in the warfarin group and 4 in the novel oral anticoagulant group. The rate of thrombotic events, composite hospital and clinic visits, and hospital readmissions were not statistically different between groups.

Conclusion: There was a strong trend towards increased risk of bleeding in patients treated with warfarin and antiplatelets compared to novel oral anticoagulant and antiplatelets. More patients were discharged on triple therapy with warfarin which may have explained the numerically higher bleeding events in this group. Thrombotic events were rare and were not statistically different between groups. Considering an anticoagulant with a single antiplatelet agent may be an option in patients to minimize bleeding without an increased risk of thrombosis; however, larger, randomized controlled studies are needed to assess antithrombotic therapy after percutaneous coronary intervention in patients requiring long term anticoagulation.

4-031

Category: Cardiology / Anticoagulation

Title: Lidocaine toxicity less than 19 hours after initiation of a continuous infusion for the treatment of ventricular tachycardia

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Case Report: Lidocaine, a Vaughan-Williams Class 1B sodium channel blocker, is utilized for the treatment of ventricular arrhythmias. Standard doses of lidocaine for this indication include an optional 1-1.5 mg/kg intravenous bolus followed by a continuous infusion of 1-4 mg/min (1-2 mg/min in patients with heart failure or hepatic dysfunction). In the absence of clinical signs of toxicity, lidocaine infusions at rates of 0.5-2 mg/min do not routinely require drug concentration monitoring in the first 72 to 96 hours of therapy. This report describes lidocaine toxicity in a 64 year old male with previously normal hepatic function less than 19 hours after initiation of lidocaine at 2 mg/min. Pertinent past medical history included chronic heart failure, ventricular tachycardia (VT), and a dual chamber implantable cardioverter-defibrillator with a right ventricular lead thrombus. A LifeVest was used to bridge the patient until the thrombus resolved and the thrombosed lead could be replaced. On a previous hospital admission for LifeVest shock, the patient was loaded with amiodarone and continued on maintenance amiodarone therapy. He presented to the emergency department after his LifeVest fired at home due to recurrent VT. Upon arrival all labs were within normal limits and the patient was able to ambulate, speak, and follow commands. His home amiodarone regimen was continued and lidocaine therapy was initiated with a 75 mg bolus (0.75 mg/kg) followed by 2 mg/min continuously. On day 2 of his hospitalization, less than 19 hours after starting therapy, a tremor, altered mental status, and inability to respond to commands were noted. A head CT ruled out an acute stroke and liver function tests were normal. Serum creatinine (SCr) had doubled and urine output decreased. Nitroprusside was started in an attempt to increase perfusion and the lidocaine was discontinued (approximately 2.2 g of lidocaine was received over the 19 hours). Concurrently, a lidocaine drug concentration was obtained and found to be 9 mcg/mL (normal: 1.2-5 mcg/mL). On the morning of day 3 of his hospitalization, the patients transaminases had increased more than 20 times his baseline. Symptomatically, the patient improved within 10 hours of discontinuing the lidocaine infusion, and after day 3, his transaminases trended towards normal. Lidocaine was restarted on day 5 for recurrent VT with a 50 mg bolus (0.5 mg/kg) followed by 0.5 mg/min continuously. The VT resolved without further adverse events from lidocaine. There is little information published about the use of intravenous lidocaine for ventricular arrhythmias and even less about dosing considerations. To our knowledge, this case is the first to describe lidocaine toxicity within 24 hours of therapy initiation while using recommended dosing for patients with concurrent heart failure. The likely mechanism of toxicity is poor hepatic perfusion

in a low cardiac output state. While lidocaine does not need to be dose adjusted based on renal function, signs of poor renal perfusion, such as decreased urine output and increased SCr, should alert the clinician that hepatic perfusion may be decreased as well. Judicious monitoring for signs and symptoms of lidocaine toxicity, including tremor and altered mental status, should be considered even in those receiving standard doses and short courses of lidocaine.

4-032

Category: Cardiology / Anticoagulation

Title: Therapeutic drug monitoring of mexiletine at a large academic medical center

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Purpose: Mexiletine is often used in management of ventricular arrhythmias. Literature regarding mexiletine levels has established a therapeutic trough range of 0.8 to 2.0 mcg/mL, however this is predominately in prophylaxis after myocardial infarction, which differs from current usage of mexiletine. Existing literature is conflicted about the correlation between serum mexiletine concentration and toxicity. Limited information exists about the current practice of measuring mexiletine levels and the impact on patient care. The purpose of this study is to describe the appropriateness of drawing serum mexiletine levels and impact on drug dosing.

Methods: A single center, retrospective analysis was conducted using electronic medical records to identify serum mexiletine levels from December 2004 to December 2014. Patients were excluded for age less than 18 years, incomplete or refusal of consent for research, or incomplete medical records preventing data collection. Individual levels were used for analysis from different hospitalizations, or during the same hospitalization if organ function or clinical situation acutely changed. Subsequent levels for the same patient during the same hospitalization purely drawn for surveillance were not included in analysis. The primary endpoint was the incidence of levels drawn as appropriate troughs (less than 2 hours prior to the next dose). Secondary outcomes included incidence of levels that prompted a dose change, reason for drug monitoring, associate of adverse events and elevated levels, incidence of adverse events, and correlation between baseline characteristics and mexiletine level.

Results: A total of 238 individual levels were included for analysis with only 109 (46.0%) levels drawn appropriately as troughs. Of the 238 levels drawn, only 31 (13.1%) prompted a dose change for the patient. Mexiletine use was primarily for the treatment of ventricular arrhythmias (96.2%) and 108 (45.6%) levels were drawn in an effort to assess efficacy. Fifty-two levels (21.9%) were drawn out of concern for adverse events. The most common adverse events reported from mexiletine use were nausea (11.8%) and dizziness/lightheadedness (9.7%). The median level concentration was similar between patients who had an adverse event and those without an adverse event (0.8 vs. 0.7 mcg/mL, respectively). There was no correlation between mexiletine level and creatine clearance (r2 -0.008), dose per day (r2 0.07), or weight (r2 0.0002). Patients with hepatic dysfunction had elevated median levels compared to those without hepatic dysfunction (0.7 vs. 1.3 mcg/mL; $p = 0.01$).

Conclusion: Mexiletine levels were often not drawn at appropriate times and seldom influence a dose change. Adverse drug events occurred even when mexiletine troughs were within the therapeutic range and were not associated with elevated levels compared to those without an adverse event. The only characteristic associate with higher mexiletine serum concentrations were patients with hepatic dysfunction. Routine therapeutic drug monitoring of mexiletine should be avoided in an effort to avoid unnecessary cost to the patient.

4-033

Category: Chronic / Managed Care

Title: Improving patient care and reducing 30-day readmission rates: the Community-Based Care Transitions Program (CCTP) pharmacy service at Sharp Chula Vista

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Purpose: According to CMS, one in five Medicare patients discharged from a hospital are readmitted within 30 days, costing over $26 billion every year. Studies have demonstrated that medication adverse events are a major cause of avoidable hospital readmissions, and lack of adherence to discharge medications contributes greatly to post-discharge adverse events. The Community-Based Care Transitions Program (CCTP) was created by the Affordable Care Act to provide transitions of care services to high-risk Medicare beneficiaries by utilizing both pharmacy services and nurse coaches. Specifically, the CCTP pharmacy program aims to reduce 30-day readmission rates and improve quality of patient care.

Methods: The CCTP pharmacist provides clinical pharmacy services throughout the patient's hospital stay. Upon admission, the CCTP pharmacist conducts an admission medication reconciliation and assesses for any barriers to medication adherence. During the patients hospitalization, the CCTP pharmacist monitors the patients medication therapy on a regular basis and works closely with an interdisciplinary team to address any medication issues. Upon discharge, a discharge medication reconciliation is performed, and the CCTP pharmacist provides the patient and/or caregiver with medication and disease state education. The CCTP pharmacist also resolves any medication-related discharge issues, including, but not limited to, checking for insurance coverage of new medications, ensuring that the patients outpatient pharmacy has a medication in stock, and obtaining written prescriptions for any necessary medications. Finally, the CCTP pharmacist conducts phone call follow-ups for eligible patients, and works closely with the CCTP coaches to provide follow-up care in the patients home. All pharmacy interventions are documented to assess quality of patient care, and are categorized as either pharmacy-initiated interventions (interventions that do not require a physician order) or physician-dependent interventions (interventions that require a physician order).

Results: From August 2014 to December 2014, the average 30-day readmission rate for CCTP patients was 12.7%, versus the institution's overall 30-day readmission rate of 17%. 219 patients were seen by CCTP pharmacy, of which 174 patients (79.5%) received pharmacy-initiated interventions and 89 patients (40.6%) received physician-dependent pharmacy interventions. The most common pharmacy-initiated interventions included updating the home medication list (n=173 patients, 79%), correcting the discharge medication list (n=55, 25.1%), providing pillboxes (n=32, 14.6%), ensuring insurance coverage of medications (n=21, 9.6%), and calling new prescriptions into the patients outpatient pharmacy (n=18, 8.2%). The most common physician-dependent pharmacy interventions included obtaining a written prescription (n=49, 22.4%), adjusting a medication dose (n=41, 18.7%), discontinuing a medication (n=30, 13.7%), and adding a new medication (n=24, 11%).

Conclusion: Clinical pharmacy services in conjunction with home visits by nurse coaches reduced 30-day readmission rates in high-risk Medicare patients, and the inclusion of clinical pharmacy services in the CCTP program improved quality of patient care during hospital admission.

4-034

Category: Chronic / Managed Care

Title: Evidence-based beta-blocker use in systolic heart failure: clinical pharmacy impact on achieving a Medicare Pioneer ACO quality measure in an ambulatory care setting

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Purpose: Carvedilol, metoprolol succinate, and bisoprolol are the only guideline-recommended beta-blockers with proven favorable effects on mortality associated with systolic heart failure. Centers for Medicare and Medicaid Services (CMS) holds Pioneer Accountable Care Organizations (ACOs) responsible for a quality measure evaluating the percentage of patients 18 years of age or older with heart failure and a current or prior left ventricular ejection fraction (LVEF) less than 40 percent prescribed one of the aforementioned beta-blockers. The objective of this study was to assess the impact of a clinical pharmacist-generated initiative on the performance of this quality measure at Atrius Health practice sites.

Methods: The MCPHS University Institutional Review Board approved this prospective, single-arm, multicenter, observational study. Clinical pharmacists developed several educational documents designed to facilitate clinician prescribing of evidence-based therapies in systolic heart failure patients. After providing live education to Internal Medicine and Cardiology departments, clinical pharmacists reviewed patient charts in the electronic medical record to determine eligibility for initiating or switching to evidence-based beta-blocker therapy. Medicare Pioneer ACO patients 18 to 85 years of age with a diagnosis of heart failure and a current or prior history of a LVEF less than 40 percent were included for review. Included patients also had a current prescription for metoprolol tartrate, atenolol, or no beta-blocker. Patients were considered ineligible if they had a documented contraindication or intolerance to beta-blocker therapy or were clinically unstable at the time of review. Recommendations to appropriately initiate or switch to an evidence-based beta-blocker were sent electronically by a clinical pharmacist to an eligible patient's treating physician prior to a scheduled office visit. The primary outcome was the change in the reported Medicare Pioneer ACO performance from year 2013 to 2014. Secondary outcomes included safety and tolerability within two weeks of beta-blocker initiation or switching.

Results: A total of 48 Medicare ACO patients with heart failure and a LVEF less than 40 percent underwent chart review by a clinical pharmacist. Of these patients, 22 patients were initiated on or switched to evidence-based beta-blocker therapy by the treating clinician. Fifteen patients were ineligible for beta-blocker therapy due to a valid medical or patient reason defined by CMS and were removed from the performance denominator. Eleven patients remained on non-evidence-based beta-blocker therapy despite eligibility to switch therapy. Final performance on this quality measure based on CMS criteria is expected to demonstrate an 8 percent

improvement, with 81.6 percent of eligible patients achieving the quality measure in 2014, an increase from 73.6 percent in 2013. Beta-blocker initiations and switches were well tolerated within the 2-week follow-up period.

Conclusion: The performance on this Medicare Pioneer ACO quality measure improved in a one-year period after a clinical pharmacist-generated initiative was implemented at Atrius Health practice sites. Clinical Pharmacists have the potential to play a direct role in improving pay-for-performance quality measures within an ambulatory care setting. The clinical and economic significance of clinical pharmacist impact on pay-for-performance quality measures must be determined in larger, comparator studies.

4-035

Category: Chronic / Managed Care

Title: Community pharmacy-based educational interventional program in Lebanon for patients with arthritis: a pilot study

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Purpose: Arthritis is a debilitating disease that needs constant care in order to ease the symptoms associated with it, minimize its complications, and improve patients' quality of life. A previous study on 90 patients over a 4 month period showed that community pharmacy based education for arthritis patients enhances disease management and lessens economic burden. The purpose of this study is to develop and implement a community pharmacy-based educational intervention for patients with arthritis and to evaluate its influence on patients' quality of life.

Methods: A prospective pilot study involving 114 patients diagnosed with arthritis, was conducted from December 1, 2014 till April 1, 2015 in four Lebanese community pharmacies. Participants were equally distributed to the study group (leaflet with oral counseling) and the control group (leaflet only). A follow-up period of four months was undertaken where patient information was reassessed after each month. A crossover was done after two months from baseline by providing oral counseling to the leaflet group. Primary endpoint was to measure the influence of oral counseling on quality of life (QOL) by evaluating changes in frequency of pain, urgent calls, general practitioner visits (GP-visits), and pain interference with: mood, enjoyment of life, walking ability, sleep, general activity and normal work. Secondary endpoints were to assess the role of pharmacists on patient compliance, the effect of education and gender on compliance, and the effect of gender on pain severity. Statistical tests used were paired sample t-test, independent sample test, Chi-square, ANOVA, Post-hoc and logistic regression.

Results: Before cross over (T1), the study group had lower GP visits compared to the control group. At the end of follow up (T3), significant improvement was seen in pain interference with sleep ($P<0.011$), normal work ($P<0.019$), walking ability ($P<0.024$), general activity ($P<0.006$), frequency of pain ($P<0.001$), GP visits and urgent calls ($P<0.001$). However no significant improvement was seen in pain interference with mood and enjoyment of life. Pharmacists counseling also promoted compliance and in so doing improved the frequency of pain, GP visits, and urgent calls. Initially, females with high level of education, in compared to secondary and basic, had higher compliance rate (19%, 13%, and 4% respectively). This wasnt evident with males. After cross over (T2), the percentage of compliance increased in both genders; highest increase was seen in males with high educational level (23%). At the end of the study, the percentage of compliance in females with high, secondary and basic educational levels was

comparable to each other (36%, 34% and 27%, respectively), and females with high educational level were all compliant. As for pain severity, females reported more of severe pain than males (26.8% vs. 17.6%) with the latter reporting more of moderate pain (70.6% vs. 55.7).

Conclusion: This community based educational intervention enhanced the QOL by minimizing pain interference with general activity, normal work and sleep. Improvement in frequency of pain, GP visits and urgent calls was also achieved by promoting compliance. This showed the importance of pharmacists counseling. Second, educational level and gender effected compliance. The ones with higher education had higher increase in compliance rate and females had a higher tendency of becoming compliant. Moreover, future studies are needed to direct gender differences in pain assessment techniques for patients with arthritis and to understand the effect of gender on frequency of medication use and doses.

4-036

Category: Clinical Service Management

Title: Development and implementation of an alemtuzumab infusion service for patients with relapsing-remitting multiple sclerosis

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Purpose: Relapsing-remitting multiple sclerosis (RRMS) results in axonal demyelination and plaque formation. Alemtuzumab, a recombinant humanized monoclonal antibody which binds CD52 on the surface of B- and T-lymphocytes, was recently approved for treatment of RRMS and has shown promise in reducing disability. Alemtuzumab was noted to have an infusion reaction incidence of more than 90% during clinical trials, requires a risk evaluation and mitigation strategy (REMS) program, and has cost implications for pharmacy budgets. This project was designed to develop treatment and monitoring protocols to assure safe and efficacious utilization of alemtuzumab for RRMS patients while employing effective fiscal management.

Methods: A multidisciplinary team was formed including major stakeholders. A literature search was initiated concentrating on efficacy and safety. Communication occurred with clinical trial study sites for insight on infusion reactions and treatment. A formulary monograph was developed to assure safe prescribing and administration, and was utilized to secure pharmacy and therapeutic committee (P&T) formulary approval for alemtuzumab. A checklist was developed delineating physician and pharmacy responsibilities before, during and after infusion therapy. An alemtuzumab order set was developed utilizing the existing disease-modifying therapy template with emphasis on safe administration. An alemtuzumab educational program was developed for pharmacists, and nurses were provided with system education regarding disease-modifying agents and infusion reactions. Additionally, as part of the REMS process, alemtuzumab-specific education and process certification was provided to infusion nurses and neurology office personnel. As alemtuzumab is given daily as an outpatient for 5 consecutive days, registration leadership was added to the multidisciplinary team to address admission issues. A communication plan with pharmacy for drug preparation was developed with the neurology office personnel, manufacturer liaison, and the nursing unit where patients were to be treated. Lastly, a pharmacy charge analyst was involved to assure proper coding, billing practice and appropriate revenue mapping.

Results: The alemtuzumab infusion service treated its first patient (first non-trial patient in the state) in March 2015. Registration leadership developed a process for deeming the patients as

"outpatients in a hospital bed" with daily discharge and readmission for the 5 treatment days. Pretreatment screening, laboratory tests and vaccines were appropriately addressed by the prescribing physician and staff. Coordination between the neurology and pharmacy services allowed for patient-specific precertification for treatment and drug procurement. The order set as well as pharmacy and nursing training and references have provided for safe administration with 12 patients treated by June 2015. During this time, the health system changed computer platforms to a computerized physician order entry program and the paper order set was converted to an electronic order panel. Post-treatment laboratory tests and follow-up continue on the part of the neurology service. Continued monitoring by a pharmacy data analyst of the alemtuzumab revenue integrity process has ensured compliance along with full and legitimate reimbursement.

Conclusion: A multidisciplinary, multi-pronged approach to address financial, REMS and safety considerations of alemtuzumab utilization led to a successful implementation of an alemtuzumab infusion service. This process can be used as a template for evaluation and process design for other complex and budget-impacting medications.

4-037

Category: Clinical Service Management

Title: Implementation of a dedicated multidisciplinary pharmacogenomics clinic

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Purpose: Clinical implementation of pharmacogenomics is a growing field. Multiple institutions are undertaking research projects to determine methods of preemptively collecting and storing genomic information and then delivering it at the point of care. In the interim, early adopters of clinical pharmacogenomics need assistance in maximizing the value of genomic data. These early adopters include clinicians and patients who believe in the value of genomics to improve pharmacotherapy. Both practitioners and patients expressed this need at our health system. To meet this need we developed a novel multidisciplinary pharmacogenomics focused clinic.

Methods: Genetic counselors, a medical geneticist, and a pharmacist are involved in the pharmacogenomics clinic. Patients can be self-referred or clinician-referred to the clinic, which involves pre-test counseling and a disclosure visit, which are separated by one to two weeks. The first visit provides the patient with information needed to decide whether or not pharmacogenomics testing is right for them. A genetic counselor reviews their medication list, takes a medication-focused family and medical history assisted with an 8-question tool, and determines patient expectations. Risks, limitations, benefits, and cost of pharmacogenomics testing are discussed. If the patient decides to proceed with testing, a 15-gene panel is typically ordered. Patients who have previously performed testing may come for the interpretive visit only. Between visits, the pharmacist reviews the results, medication list, and patients medical record. The pharmacist clinically interprets the patients genotype, which is also translated to phenotypes and, in conjunction with other clinical information, makes recommendations for current and future pharmacotherapy. The genomic results and recommendations are summarized into a report that is given to the patient and patient-selected physicians. At the disclosure visit the medical geneticist and pharmacist meet with the patient to discuss the results and answer any questions.

Results: .During the first three months of the clinic, 30 patients have been tested. Of these patients, 29 (97%) have had clinically relevant variants. On average, patients have had 3 clinically relevant variants. The discovery of these variants has led to recommendations about pharmacotherapy. The most common reasons physicians have referred a patient are pain management and treatment for psychiatric disorders. Based on patient and clinician feedback, the clinic visits and test results have been informative and valuable.

Conclusion: The ultimate goal of the clinic is to assist clinicians in using genomic data to optimize pharmacotherapy and improve patient outcomes. Most patients tested have had clinically relevant variants linked to drug response. Through the clinic we are ensuring patients and physicians have realistic expectations of pharmacogenomics testing, obtain appropriate genomics results, receive these results interpreted as clinically useful information in the context of the patients clinical picture, and are empowered to use pharmacogenomics data in patient care. Clinics like this are a new practice area where pharmacists can improve patient care with their unique knowledge of pharmacotherapy and pharmacogenomics.

4-038

Category: Clinical Service Management

Title: Impact of a pharmacist-managed renal dosing and antimicrobial dose optimization protocol in a community hospital

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Purpose: Reduction of drug dosages for patients with renal insufficiency is a widely accepted standard of practice, however, initial dose reductions should be followed with a revision of medication dosage regimens based on changes in renal function, particularly in patients with acute kidney injury. Pharmacodynamic dosing strategies that optimize bacterial killing in the clinical setting are now defined for many commonly used antibiotics, including beta-lactams and fluoroquinolones. Our protocol was developed to facilitate required dose adjustments for adult patients based on renal function, including incorporation of antibiotic dose optimization while avoiding unnecessary phone calls to prescribers.

Methods: A pre-existing renal dosing protocol was converted to an automatic dosing protocol based on consistently high acceptance rates by prescribers. In addition, the protocol was modified to include evidence-based antimicrobial dose optimization regimens for cefepime, levofloxacin, meropenem, and piperacillin/tazobactam. Prior to the order verification process, staff pharmacists assessed patients' renal function using creatinine clearance estimated by the Cockcroft-Gault equation. If indicated, the pharmacists automatically adjusted the doses of medications covered by the protocol in accordance to the outlined medical staff-approved dosing guidelines. Subsequent changes in renal function was monitored daily via prebuilt rules in our real-time clinical monitoring system, VigiLanz. Unit-based clinical pharmacists made necessary dosage revisions based on any changes in renal function. The automatic dosage adjustments documented as interventions in VigiLanz by pharmacists over a 12 month-period were retrospectively reviewed.

Results: A total of 2,909 automatic dosage adjustments were made for 899 patients by pharmacists between June 1, 2014 and May 31, 2015 based on the protocol. 62% constituted a combination of dose optimization and renal dosage adjustments for cefepime, levofloxacin, meropenem, and piperacillin/tazobactam. Dosages for levofloxacin and famotidine were the most frequently reduced (575 and 298 doses respectively); cefepime and enoxaparin doses were the most frequently increased (315 and 305 doses respectively). Frontline staff pharmacists accounted for making up to 65% of the dosage adjustments while clinical pharmacists and residents accounted for the remainder.

Conclusion: Our protocol provided the opportunity to make timely dosage adjustments based on renal function, thereby minimizing potential for adverse effects and optimizing efficacy. Because

the dose adjustments no longer required phone calls to physicians, less time was spent by both pharmacists and physicians on the phone. Involvement of the frontline staff pharmacists allowed unit-based clinical pharmacists more time to focus on providing more complex, specialized clinical pharmacy services.

4-039

Category: Clinical Service Management

Title: Pharmacy bariatric consult service

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Purpose: Pharmacokinetic and pharmacodynamics properties of medications can be significantly affected by bariatric procedures. Bariatric patients often require complex medication regimens, and current literature lacks information regarding proper pharmaceutical care. A pharmacist bariatric consultation service can allow of collaboration between surgeons and pharmacists to effectively manage these patients.

Methods: This pilot project centers around the development of a pharmacy bariatric consult service. This service will include patient identification, pharmacy referral, medication reconciliation, pharmacist consultation with the patient, medication evaluation, and inpatient drug therapy monitoring. Furthermore, the service will also include communication of recommendations with the prescriber, medication education prior to discharge, educational support of clinicians, and documentation. Quantitative data for this project will focus on number of consults preformed, average medications optimized per patient, and percentage of prescriber approved recommendations.

Results: From April 2015 to June 2015, DePaul Health Center pharmacists reviewed 40 bariatric patient medication profiles. The pharmacists provided 124 recommendation on these patients with an average of 3 medications optimized per patient. The majority of our accepted recommendations were the selection of analgesic medications and vitamin supplements. Similarly, recommendations were also accepted regarding conversion of long acting medications to immediate release forms that could be crushed or switched to solution form. At our institution, hospitalists approved 76.6% of the total pharmacist provided recommendations.

Conclusion: With the growing demand for bariatric surgery comes the added responsibility of the health care team to ensure safe and effective medication dosing for these patients. As such, the clinical pharmacist can serve as an integral resource especially given the lack of available literature regarding proper dosing in this patient group. This collaborative effort between hospitalists and pharmacists improved pharmaceutical care of our bariatric patients at our institution in terms of proper medication size, crushing of medications, and selection of therapeutic alternatives to reduce complication, and optimize patient medication adherence and patient safety.

4-040

Category: Clinical Service Management

Title: Implementation of pharmacist responsibilities in compliance with centers for Medicare and Medicaid services requirements to ensure safety and wellbeing of kidney transplant donors and recipients

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Purpose: Centers for Medicare and Medicaid services implemented new guidelines requiring a pharmacist as a member of the solid organ transplant multidisciplinary team. As a member of this team, the pharmacist is required to contribute to the care of renal transplant donors and recipients prior to transplant, during the transplant phase, and upon discharge. It is a requirement that all communication be documented and acknowledged by other team members. This project was implemented to develop a proper procedure to comply with the new Centers for Medicare and Medicaid services guidelines.

Methods: In 2008, a pharmacist with postgraduate residency training was selected to join the multidisciplinary renal transplant team and participate without dedicated time. The pharmacist was required to perform medication reviews on the recipient within 24 hours of transplant. The pharmacist assisted in the identification of medication dose adjustments, toxicology interventions, medication interactions and evaluation of pain control of the donor and recipient. They attended the transplant patient review committee meetings and obtained a minimum of five continuing education hours per year in the areas of nephrology and transplantation. In 2014, it was identified that not all areas of the multidisciplinary team were in compliance with the Centers of Medicare and Medicaid Services requirements for reimbursement. With regards to pharmacy involvement, it was determined that written communication of medication review would need to be performed prior to transplant, during the transplant phase and at discharge for both the donor and the recipient. It was also determined that coverage of both patients would need to be continuous throughout all shifts, and all members of the pharmacy transplant team would need to prove competency through the completion of continuing education credits. All policies for these actions would need to be developed.

Results: Under the direct supervision of the original transplant specialist, five additional pharmacists were identified to cross cover during weekends and evenings. Each was required to complete a module exam with minimum passing scores of ninety percent and new modules yearly. Additionally, one pharmacist was also identified to provide support during normal operational hours in the absence of the transplant specialist. The transplant specialist was required to complete medication reviews when recipient and donors are activated on waitlist, during their transplant phase and at discharge. Documentation prior to transplant occurs by written documentation in patient charts when notified by transplant coordinator or if pharmacist

is present at transplant patient review committee. These responsibilities would be assigned to support pharmacists on weekends and during weekday evenings. Medication review prior to transplant encompasses future drug interactions with immunosuppressant therapy, current medications dosing adjustments, and dose adjustments if renal function improves or declines. At the transplant phase, interventions that are identified during medication review include interactions with immunosuppressant therapy, dose adjustments, pain management, urine output and pharmacokinetic monitoring of immunosuppressant therapy. At discharge, recommendations are made for medications needing monitored via levels, drug interactions and dosing adjustment, along with any potential issues acquiring medication.

Conclusion: Currently all CMS requirements are being met with competency and medication reviews at all three nodes of patient care for both the recipients and donors. Challenges still faced include continuity of pharmacy oversight. The current staffing model involves pharmacist rotating shifts and weekend rotations, which presents difficulty in fulfilling the around the clock requirement.

4-041

Category: Critical Care

Title: Surviving ST-elevation myocardial infarction (STEMI) and stenting: strategies to ensure safe transitions in high risk patients

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Purpose: Premature discontinuation of dual antiplatelet therapy is a strong independent risk factor for coronary stent thrombosis. A study demonstrated that a delay of greater than 3 days in filling a first prescription for clopidogrel after hospital discharge was associated with mortality rate of up to 15% and readmission with myocardial infarction of 10%. The national readmission rate for ST-segment elevation myocardial infarction (STEMI) patients is 14.5%. The reasons are multifactorial and include: comorbidities, non-adherence to medications, a reduced level of health literacy and insufficient discharge planning. This study evaluates the impact of pharmacist-managed STEMI medication education, discharge instruction, and

Methods: A prospective study was performed to analyze the difference in outcomes between a pre-intervention group in 2013 and a post-intervention group over a three-month period in 2015. Patients admitted to our institution with a diagnosis of STEMI who received stents were included. During the hospital admission, the pharmacists responsibilities included obtaining an accurate medication history (prior to admission medication list) and reconciliation with inpatient orders, providing medication education with a focus on the importance of taking dual antiplatelet therapy, ensuring patients were able to obtain their antiplatelet medications which included working with patient assistance programs, and facilitating the delivery of discharge medications. Post-discharge telephone calls were performed within 48-72 hours and at 30 days. A numerical assessment of medication adherence and literacy (MedAL) was performed, based upon a tool developed at our organization, for each patient as part of the medication history and again during post-discharge phone calls. The primary outcome was 30-day all-cause readmission. Secondary outcomes included changes in medication adherence and literacy from baseline to 30-day post-discharge, readmission with requirement of coronary intervention (i.e. stent placement), and time to first discharge prescription fill. The time involved in performing medication reconciliation and follow up calls was also measured.

Results: A total of 95 patients in the baseline and 41 patients in the intervention group were included in the study. One patient was excluded in the intervention group due to loss to follow-up. All-cause readmission at 30 days decreased from a baseline of 13% (12/95) to 5% (2/40). Medication adherence and literacy (MedAL) scores improved significantly from a baseline score of 4.5 which represents low adherence and/or literacy to a score of 8 which represents a high score at 30 days post-discharge ($p=0.0005$). During the baseline period, 3 of the 12 patients who

were readmitted required stent placement, while none of the patients in the intervention group required stent placement during the readmission episode. The cause of readmission for the 2 patients who were readmitted in the intervention group was congestive heart failure unrelated to acute coronary syndrome (ACS). All patients in the intervention group filled their discharge prescriptions within 3 days. The pharmacist time to perform medication reconciliation and education was 21.4 9.4 minutes per patient. The time requirement for the two telephone follow-up calls on average was 22.2 12.3 minutes.

Conclusion: This study showed both a reduction in readmissions and a significant increase in medication adherence and literacy in patients at risk for morbidity and mortality. Patients also received their medications within 3 days which is essential in this population. Pharmacist can play a critical role in ensuring safe medication transitions in patients with STEMI who receive stents. Results of the study have been shared within our organization and the methodology is being integrated into our transitions of care program.

4-042

Category: Critical Care

Title: Intermittent infusions of intravenous epoprostenol for the management of severe raynauds phenomenon in a patient with symptoms refractory to conventional therapy

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Case Report: Raynauds phenomenon (RP) refers to a disorder of the blood vessels in which the fingers and toes suddenly experience decreased blood flow due to cold temperature or emotional distress. Resultant ischemia to the extremities from painful vasospasms can lead to the formation of digital ulcers. Calcium channel blockers are often used as first line agents to treat RP, but alternative oral (PO), topical, and intravenous (IV) therapies may be needed to reduce the frequency and severity of attacks when monotherapy provides inadequate symptomatic relief. Prostanoid therapy has been used historically to treat patients with severe RP refractory to conventional treatments. The prostacyclin analog iloprost has been studied extensively to treat RP in Europe, but is not commercially available in an IV formulation in the United States. Despite having a smaller evidence-base than IV iloprost, IV epoprostenol may represent an option for patients who have exhausted other pharmacological therapies. This case report describes the use of epoprostenol in a patient with severe RP to reduce the severity of attacks and promote digital ulcer healing. We present a 59 year-old female with a past medical history of hypothyroidism, anxiety, and depression, with RP-related symptoms that are refractory to PO extended-release nifedipine 30 mg. The patient was referred by her rheumatologist to the hospital with necrosis of her left 4th and right 3rd fingertip for sympathetic block with concurrent epoprostenol infusion. After admission to the intensive care unit the patient was started on an IV infusion of epoprostenol at 2 ng/kg/min, titrated by 0.5 ng/kg/min every 30 minutes, as tolerated, to a maximum dose of 8 ng/kg/min for a total of 6 hours every day for 3 days. She received 6 ng/kg/min of epoprostenol on the second day, but could only tolerate up to 7.5 ng/kg/min on the last day due to treatment limiting nausea. After completing the third infusion, the patients fingers were reported to be notably warmer with improved circulation. The patient was also treated with a sympathetic nerve block of the right upper extremity using 6 mL of bupivacaine 0.25 percent solution, which improved pain in her right hand temporarily. Unfortunately, the pain returned four days later and she required surgical intervention to treat her gangrenous fingers. The mechanical interventions performed included a left hand and wrist sympathectomy, left ring finger debridement, and right long finger distal amputation. Upon discharge sildenafil 20 mg PO three times daily was added to her outpatient drug regimen in addition to her home doses of aspirin 81 mg PO daily and extended-release nifedipine 30 mg PO daily for chronic management. As this case suggests, IV epoprostenol may be an appropriate therapeutic modality in patients with severe, refractory, RP and digital ulcers. Although there is limited clinical trial evidence for this use, IV epoprostenol had the intended effect in our patient, as there was an

observed improvement in forearm blood flow, increase in fingertip skin temperature and salvage of one of her digits.

4-043

Category: Critical Care

Title: Implementation of Strategies for Nitroprusside and Isoproterenol

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Purpose: Nitroprusside is currently used for several indications including management of hypertensive crises, acute decompensated heart failure, post-operative therapy following heart and/or vascular surgery, and controlled hypotension to reduce bleeding during surgery. Isoproterenol is indicated for use in asthma, cardiogenic shock, various cardiac arrhythmias, Brugada syndrome with electrical storm, and head-upright tilt test. The prices of nitroprusside and isoproterenol have risen dramatically and have now placed both medications at a financial disadvantage to other therapeutic alternatives. A system-wide robust consensus building process targeted opportunities to identify clinical alternatives and operational efficiencies to ensure optimal patient outcomes while making sound financial decisions.

Methods: In February of 2015, after the initial price increase, teams were formed with pharmacy and physician representatives from across the country. Recommendations were developed and communicated to the members of the health-systems. In May and June 2015 a more formalized group was created with a team lead and representatives from across the country. There were four virtual meetings of the team to develop the recommendations based on literature evaluation, best practice sharing, and consensus building. The work of the expert group included development of executive summary slides and an SBAR document to provide additional background. The final recommendations were then presented at a face to face national health-system meeting in Nashville, Tennessee to gain approval from the Therapeutic Affinity Group and communicated to all health-system clinical leaders for comment over a 14 day period. Once all concerns were addressed, approval by the Clinical Executive Committee and Ascension CMO was obtained. Health-system sites were then given 90 days to implement the initiative.

Results: The nitroprusside recommendations were to remove use in the perioperative hypertension scenarios and move to niCARdipine or clevedipine. The isoproterenol recommendations were to remove the use for tilt-table testing and replace with nothing or sublingual nitroglycerin. In addition, it was recommended to implement operational practices to change how isoproterenol is dispensed to the electrophysiology lab. Evaluation was ongoing to determine an alternative for supraventricular tachycardia generation in the electrophysiology lab to possibly epinephrine. The use of both medications was reduced by 50% for an almost 4 million dollar savings.

Conclusion: As prices for generic injectable agents increase dramatically, it is important to evaluate the clinical need and operational opportunities to ensure best patient outcomes while ensuring cost effective care. Working together in a large health system to include representatives for a robust consensus process ensures well vetted recommendations with a high acceptance and implementation rate.

4-045

Category: Critical Care

Title: Outcome comparison of 3% hypertonic saline for correction of hyponatremia between a community and teaching hospital in a single hospital system

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Purpose: Severe hyponatremia is a life-threatening condition that can result in seizures, brain edema and death. Hypertonic saline 3% (HS-3%) is a critical intervention for patients with severe hyponatremia although is a high alert medication. Rapid or overcorrection of chronic hyponatremia has been associated with development of Osmotic Demyelination Syndrome (ODS), thus a cautious and judicious approach to correction is prudent. A mandated preformatted order set (PFO) was created for correction of hyponatremia using HS-3% and patterns of usage between hospital sites explored in the current analysis. In addition, the literature was reviewed for updated recommendations regarding use of HS-3%.

Methods: A retrospective chart review of HS-3% utilization data for correction of hyponatremia was conducted across two hospital sites, one at Hospital A (teaching facility) and one at Hospital B (community facility). Data between January 1st 2013 and November 30th 2014 was screened for utilization of HS-3% for correction of hyponatremia. Utilization of HS-3% for all other indications such as resuscitation or treatment of elevated intracranial pressures were excluded. Seventeen (n=17) and thirteen (n=13) patients were identified as receiving HS-3% for correction of hyponatremia at Hospitals A and B, respectively. Demographic variables including age, gender, height, weight, prescribing provider, presenting symptoms, etiology, initial sodium value, and hospital location received were collected. Appropriate completion of the PFO was analyzed by describing frequencies that particular use criteria were met. A quantitative analysis of infusion characteristics including infusion time, infusion rate, volume infused, sodium level at time of discontinuation, and rise in sodium levels was conducted. Due to small sample size, non-parametric statistical tests including the Mann Whitney U-test for continuous data and Fishers Exact Test for categorical data were used for analysis. Two-tailed hypothesis testing with an alpha value of 0.05 was considered significant in all experimental statistical testing.

Results: No differences were found between groups in demographic variables or presenting etiology of hyponatremia. There was a significant difference in the distribution of symptoms between sites with Hospital A having more patients presenting with Altered Mental Status (AMS), encephalopathy, coma, or seizure while Hospital B had more patients presenting as asymptomatic or with nausea (p=0.003). Patients at Hospital A had lower initial sodium levels (112.94 mEq/L 5.41 vs 116.23 mEq/L 5.02, p = 0.116), received larger volumes (507.23ml 449.33 vs 333.58ml; 213.76, p =0.275), longer infusion durations (20.93 hr 19.53 vs 11.69 hr 6.05, p=0.562) and had larger corrections in sodium values (9.47 mEq/L 6.73 vs 7.77 mEq/L

4.49, p=0.503), although differences did not reach statistical significance. Overall compliance and appropriateness of PFO completion was low with 35% (6/17) at Hospital A and 38% (5/13) at hospital B. Despite low rates of appropriate PFO completion Hospital A and B picked an appropriate rate of administration in 50% (4/8) and 37.5% (3/8) of cases in which the PFO was judged as not completed appropriately. There was a single incidence of ODS at Hospital A.

Conclusion: Patients at Hospital A had presenting signs, symptoms, and initial sodium values that warranted use of HS-3% and were treated more aggressively while patients at Hospital B often lacked signs and symptoms warranting use of HS-3% although received more conservative treatment. Current evidence from the literature suggests an initial correction of 4-6 mEq/L is sufficient for resolution of severe neurological symptoms and recommendations for PFO amendments were made. Significant opportunities exist at both Hospital sites for improving compliance with the use of the mandatory PFO for utilization of HS-3% for correction of hyponatremia.

4-046

Category: Critical Care

Title: De-escalation of antibiotic therapy in adult ICU patients utilizing procalcitonin and a multidisciplinary rounding approach

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Purpose: For more than a decade the utility of procalcitonin's diagnostic value has been studied guiding the initiation, appropriateness, and duration of antibiotic therapy in bacterial infections, mostly respiratory and sepsis. Procalcitonin's usefulness has met with mixed results, but more recently has proved to be helpful in reducing ICU antibiotic days, length of stay, reinfection rates, and ventilator time. At our institution we utilize a multidisciplinary rounding approach for daily patient rounds in the ICU. The purpose of this study was to evaluate if incorporating a procalcitonin-guided antibiotic de-escalation strategy with daily rounds could reduce unnecessary antibiotic days in the ICU.

Methods: The antibiotic de-escalation strategy was performed prospectively in our institution's ICU during multidisciplinary rounds by a clinical pharmacist and an intensivist for all patients admitted with suspected infection during the month of March 2015. The primary endpoints were total ICU days of antibiotic therapy (DOT),length of ICU antibiotic therapy (LOT), and ICU length of stay. Data collected was then normalized per 1,000 patient admissions and patient days and compared to a historical control from March 2014. To summarize, if antibiotics were begun because bacterial infection was suspected, a STAT procalcitonin (PCT) was ordered. If the PCT was less than 0.5mcg/L, a second PCT was ordered in 6-12 hours to confirm that an evolving infection was not present. If the repeat PCT was still less than 0.5mcg/L, antibiotics were discouraged. If the PCT was >/= 0.5mcg/L, antibiotics were encouraged. If antibiotics were continued, a follow-up PCT was drawn on day 2. If cultures were negative on day 2 and PCT was </= 0.5mcg/L, antibiotics were again discouraged. If cultures were positive, antibiotics were streamlined accordingly. The same procedure was repeated for day 3. If antibiotics were still not discontinued or streamlined, an infectious diseases consultation was strongly recommended.

Results: We were able to show a significant impact on ICU antibiotic days, both DOT and LOT, and a small decrease in ICU LOS, although not significant, despite an increase ICU patient admissions and ICU patient days from March 2014 versus March 2015. Total ICU admissions increased from 220 in March 2014 to 262 in March 2015 (19.1%). Total ICU patient days increased from 649 to 758 (16.8%) in March 2015 over March 2014. Of the total admissions March 2015, 77/262 (29.4%) had at least one PCT drawn. Total antibiotic days (DOT) decreased from 1,252 to 1,229. DOT normalized per 1,000 ICU admissions decreased from 5,691 to 4,691 days. DOT per ICU patient day decreased from 8.8 to 6.2 days. DOT normalized per 1,000 ICU

patient days fell from 1,929 to 1,621 days. LOT dropped from 625 to 566 days. LOT per ICU patient day dropped from 4.4 to 2.8 days. LOT normalized per 1,000 ICU admissions decreased from 2,841 days to 2,160 days. LOT normalized per 1,000 ICU patient days decreased from 963 days to 747 days. ICU LOS essentially remained the same at 2.98 days in 2015 versus 3 days in 2014 despite a 16.8% increase in patient days.

Conclusion: While the previous literature evaluating the effectiveness of using procalcitonin to guide antibiotic therapy has not been entirely conclusive, our small study has shown promise in the initial phase. We are currently in the process of implementing computerized data mining software in order to aid in tracking and trending our data more efficiently, and to be able to offer feedback to our intensivists and infectious diseases physicians. It is our hope that as we continue to develop and acclimate to the de-escalation protocol with our daily rounds, that the promising trend will continue.

4-047

Category: Critical Care

Title: Antithrombin supplementation in adult extracorporeal membrane oxygenation: evaluation of an institutional protocol

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Purpose: Antithrombin is used in patients on extracorporeal membrane oxygenation (ECMO) to augment heparin anticoagulation and prevent circuit clot formation. Dosing and antithrombin goal levels in this population are not well defined leading to heterogeneity of use amongst providers. In December 2013 a protocol was developed to homogenize antithrombin use in the cardiovascular surgery intensive care unit. The purpose of this study is to evaluate adherence to an institutional antithrombin protocol and summarize associated utilization and cost-savings.

Methods: This was a single-center, retrospective chart review comparing protocol adherence pre- and post-education of ECMO perfusionists. The pre-education timeframe was from December 2013 to November 2014 and the post-education timeframe was from December 2014 to May 2015. This data was compared to baseline information collected prior to protocol implementation. All adult patients on ECMO who received antithrombin supplementation during the study timeframes were included. The protocol set an antithrombin cutoff level of < 40% for supplementation and provided an equation to calculate an antithrombin dose needed for a goal antithrombin level of 60%. Doses were rounded to the nearest vial size.

Results: A total of 41 patients were included, 30 in the pre-education group and 11 patients in the post-education group. This represented 45% and 38% of total adult ECMO patients in each timeframe, respectively. All other patients excluded did not receive antithrombin. Median age in each group was 55 and 60 years, 60% and 65% of patients were male, and the majority of patients were Caucasian (90% and 91%). Median days on ECMO were 7 and 9 days, respectively. The majority of patients were on veno-arterial ECMO (80% and 82%) and the primary indication for ECMO was cardiac dysfunction (70% and 91%). Adherence to the antithrombin level supplementation cutoff of < 40% improved from 28% prior to protocol implementation to 34% pre-education and 50% post-education. Utilization of antithrombin was reduced by 84.6% leading to a total yearly cost decrease of 72.4%.

Conclusion: Use of antithrombin in patients on ECMO remains a heterogenous practice in the literature. An institutional protocol was developed to homogenize practice in a large academic medical center. Protocol implementation in combination with ECMO perfusionist education significantly reduced antithrombin utilization by 84.6% and yearly cost by 72.4%. Consideration

for homogenizing use amongst other institutions may lead to decreased extraneous antithrombin use.

4-048

Category: Drug Information

Title: Flipped classroom versus traditional lecture for teaching non-inferiority trials and meta-analyses

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Purpose: Non-inferiority trials and meta-analyses are essential tools for clinical pharmacists. Flipped classroom is a pedagogical approach where students view content prior to class sessions, with class sessions completely dedicated to reinforcement of higher level concepts and skills using active learning. Flipped classroom is becoming increasingly popular in pharmacy education; however, published information directly comparing student performance with flipped classroom compared to traditional lecture is lacking from the pharmacy and non-pharmacy education literature. The objective of this study was to compare flipped classroom versus traditional lecture for teaching drug literature evaluation concepts related to non-inferiority trials and meta-analyses.

Methods: Content was taught in a required second professional year course at a 4-year doctor of pharmacy program. Learning objectives were developed using 2016 Accreditation Council for Pharmacy Education (ACPE) Standards, and mapped to two course outcomes: 1) compare and contrast the expected components, strengths, limitations, and usefulness of a clinical study, and 2) explain and assess the biostatistics used in a clinical study. Content was taught as traditional lecture, incorporating brief active learning (i.e., audience response polling, think-pair-share) in year 1. Content was taught using flipped classroom in year 2. In the flipped classroom cohort, students reviewed a handout covering terminology and concepts prior to class. Class time consisted of moderate-length active learning (i.e., group discussion, problem-solving) with no planned lecture. This was the only significant change from year 1 to 2. Student performance was assessed using multiple-choice and short answer examinations. Twelve questions assessing pre-determined learning objectives were selected for comparison between year 1 and 2; 9 were identical and 3 were nearly identical. Student performance was compared using chi-square and Fishers exact tests for multiple-choice items and the student t-test for short answer questions using a 5% alpha. Continuous data are presented as mean +/- standard deviation.

Results: Mean overall course performance was similar between year 1 (82 +/- 8%) and year 2 (85 +/- 7%). Mean age (25 +/- 4 years) and sex (60% female) were similar between years. Examination data were available for 59 students in year 1 and 71 students in year 2. Performance improved from year 1 to year 2 for most multiple choice items in terms of percentage of correct responses: question 1 5% vs. 63%, $p<0.001$; question 2 68% vs. 94%, $p<0.001$; question 3 47% vs. 83%, $p<0.001$; question 4 63% vs. 76%, $p=0.098$; question 5 85% vs. 90%, $p=0.35$; question 7 54% vs. 82%, $p=0.001$; question 9 90% vs. 99%, $p=0.046$; question 10 81% vs. 87%, $p=0.35$; question 12 44% vs. 65%, $p=0.018$. Performance improved from year 1 to year 2 for most free response items: question 6 mean 2.0 +/- 1.0 vs. 2.4 +/- 0.65 out of 3 points, $p=0.014$; question 8

mean 1.4 +/-0.62 vs. 1.7 +/- 0.55 out of 2 points, $p=0.018$; question 11 mean 2.1 +/-0.82 vs. 2.7 +/- 0.50 out of 3 points, $p<0.001$.

Conclusion: Use of flipped classroom resulted in improved performance in 9 of 12 pre-specified test items mapping to key learning objectives compared to traditional lecture. Future versions of the course will continue to incorporate flipped classroom pedagogy.

4-049

Category: Drug Information

Title: Use of intention-to-treat in randomized, controlled trials of anti-infectives

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Purpose: Intention-to-treat (ITT), an approach where all randomized subjects are evaluated regardless of completion, is generally preferred in superiority randomized, controlled trials (RCTs). It is considered externally valid, reflecting issues commonly encountered in clinical practice, such as non-adherence and loss to follow up. A variety of approaches have been reported to be used to handle missing data when ITT is employed; however, no one approach is preferred. The objectives of this study are to describe the extent to which ITT analysis is used and practices used in order to handle missing data due to attrition in RCTs of anti-infective medications.

Methods: This was a cross-sectional study of RCTs on anti-infective medications published from January 1, 2013 through December 31, 2014. A PubMed search identified all relevant articles published in specialty infectious diseases journals (i.e., Antimicrobial Agents and Chemotherapy, Clinical Infectious Diseases, Journal of Antimicrobial Chemotherapy, Journal of Infectious Diseases, Lancet Infectious Diseases). General medical journals known to publish impactful RCTs of anti-infectives (i.e, British Medical Journal, Journal of the American Medical Association, Lancet, and New England Journal of Medicine) were manually reviewed. Articles that were cross-over trials, did not assess efficacy as a primary endpoint, had a sample size of less than 50 patients, and assessed vaccinations were excluded. Each article was reviewed by two independent reviewer. Discrepancies in data extraction were resolved by consensus under consultation of a third independent reviewer. In order to build inter-rater consistency, data collection was piloted for 3 articles that met study criteria prior to beginning the study. Data were analyzed using descriptive statistics.

Results: The initial literature search identified 187 articles, 98 of which satisfied study criteria. Common reasons for removal were non-anti-infective intervention (n=34), not an RCT (n=21), fewer than 50 patients (n=14), and lack of efficacy endpoint (n=11). The most common medication classes were antibacterials (26%), hepatitis C antivirals (23%), antiretrovirals (22%), and antimalarials (5%). Most studies contained 2 (63%) or 3 (21%) treatment groups; 31% of studies were non-inferiority trials. Median enrolment was 414 patients (interquartile range [IQR] 160 to 760). ITT and modified ITT (mITT) were each described as the primary data analysis approach in 40% of studies; for the mITT studies, the most common modification was to assess all patients who received at least one dose of study drug (74%). Forty-three percent of studies

used multiple data analysis approaches. The most commonly used approaches (non-exclusive) were ITT (53%), mITT (50%), and per protocol (37%). Of the 30 non-inferiority trials, 15 described use of either ITT or mITT and per protocol analysis. The approach used to account for missing data due to attrition was described in 28 studies (29%); the most commonly described approaches were assumed treatment failure (12 of 28) and last observation carried forward (4 of 28).

Conclusion: ITT or mITT were employed in the majority of this sample of anti-infective RCTs; for the mITT studies, the most common modification used was to only assess patients who received at least one dose. Only half of the included non-inferiority trials assessed either ITT or mITT and per protocol analysis, as recommended in CONSORT guidelines. Most studies did not describe approaches used to account for missing data. For those studies that report this information, the most commonly described method was to assume treatment failure, which would also be considered the most conservative approach.

4-050

Category: Drug Information

Title: Longer-term safety and tolerability of canagliflozin in patients with type 2 diabetes: a pooled analysis

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Purpose: The sodium glucose co-transporter 2 (SGLT2) inhibitor canagliflozin (CANA) lowers the renal threshold for glucose, thereby increasing urinary glucose excretion and resulting in a mild osmotic diuresis and net caloric loss. In clinical studies, CANA improved glycemic control, body weight, and systolic blood pressure. Although generally well tolerated, CANA was associated with an increase in adverse events (AEs) related to its mechanism of action. This analysis evaluated the longer-term safety and tolerability of CANA 100 mg and CANA 300 mg in a broad population of patients with T2DM using pooled data from seven placebo- or active comparator-controlled studies.

Methods: The 5,598 patients included in this analysis received CANA 100 mg (n = 1,557) or CANA 300 mg (n = 1,932), either as monotherapy or in combination with various background antihyperglycemic agents, or non-CANA (placebo, sitagliptin, or glimepiride; n = 2,109) for a period of 52 or 104 weeks. The mean duration of exposure for CANA 100 mg, CANA 300 mg, and non-CANA was 65.1 weeks, 63.5 weeks, and 59.6 weeks, respectively, and 34%, 32% and 27% of patients were exposed for at least 102 weeks. Safety was assessed based on AE reports, with additional data collection prespecified for selected AEs.

Results: Across the CANA 100 mg, CANA 300 mg and non-CANA groups, there were similar incidences of overall AEs (73.7%, 74.5%, and 73.7%, respectively), AEs leading to discontinuations (5.1%, 6.4%, and 4.8%, respectively), and serious AEs (8.2%, 7.6%, and 8.8%, respectively). In the three patient groups, the most common (≥5%) AEs were: nasopharyngitis (9.2%, 9.9%, and 9.4%, respectively), urinary tract infections (UTI: 9.6%, 7.8%, and 6.9%, respectively), vulvovaginal candidiasis (7.5%, 7.1%, and 1.7%, respectively), back pain (5.8%, 5.6%, and 4.6%, respectively), polyuria/pollakiuria (5.7%, 5.2%, and 1.8%, respectively), and influenza (5.2%, 4.6%, and 4.0%, respectively). The incidence of AEs related to the mechanism of SGLT2 inhibition (UTI, genital mycotic infection, and polyuria/pollakiuria) were higher in the CANA groups compared with the non-CANA group. However, the incidences of AEs related to volume depletion were low (<3%) and similar across groups.

Conclusion: CANA 100 mg and 300 mg were generally well tolerated in a broad population of patients with T2DM in studies up to 104 weeks in duration, with a safety profile consistent with that of previous studies.

4-051

Category: Drug-Use Evaluation

Title: Evaluation of STAT Order processing time at Tertiary Hospital

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Purpose: STAT medication is defined as an order prescribed by physicians usually for urgent and life threatening conditions .The STAT should be administered immediately or within a limited time frame specified by facilitys policy. The turnaround time to process STAT order as well as the type of STAT order medication is a Crucial for improving patient care and quality of health Care System. We aim to evaluate the turnaround time of STAT Order Process and determine the appropriateness of ordered STAT Medication.

Methods: The study was carried out over one month period at tertiary care hospital. STAT Medication orders were collected and reviewed by 4 independent Pharmacists Retrospectively. The processing time were divided into 3 phases; Phase I (from prescribing to receiving orders), Phase 2 (From receiving orders to Pharmacy Verification and Phase 3 (From verification to administration by Nurse).The collected data included total processing time , the time period for each phase, medication type, unit type data Descriptive analysis was performed using Excel Software

Results: 222 STAT orders were reviewed. 18 Percent accounted for SICU, 16 percent accounted for inpatient medicine ward, 15 percent accounted for MICU, and 15 percent (n equal 34) accounted for Obstetrics and Gynecology department The mean total time for processing all orders was 74 minutes. The average phase 1 time was 18 minutes while the average time for phase 2 was 13 minutes .The mean phase 3 was 42 minutes Additionally, The analysis found that 15.31 percent of all orders were administered within 30 minutes from prescribing time, 37.3 percent within 45 minutes, 54.5 percent within one hour, while 45.5 percent of all orders were administered within more than one hour. Most ordered medication categories were pain management medications (14.9 percent), glycerin suppository (13.1), Magnesium Sulphate (12.6percent), emesis management medications (8.1 percent), Furosemide (6.3 percent), potassium chloride (5.9 percent), Ketamine (4.1 percent), Antihypertensive medications (3.6 percent), corticosteroids (3.6 percent), Blood proteins (human albumin, plasma protein)(3.2 percent).

Conclusion: The STAT order neeed dramatic improvement.Our study gave a model for tertiary hospitals to evelaute the STAT order process

4-052

Category: Drug-Use Evaluation

Title: Assessing The Appropriateness Of Prescribing And Monitoring Erythropoiesis Stimulating Agent (ESAs) For Treatment Of Anemia Among Chronic Kidney Disease Patients In Tertiary Hospital In Qatar.

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Purpose: The aim of this study was to investigate if prescribing and monitoring Erythropoiesis Stimulating Agent among Chronic Kidney Disease patients in Alkhor Hospital is appropriate according to Kidney Disease Outcomes Quality Initiative(KDOQI) practice and clinical recommendation Guidelines 2006 along with FDA safety announcement 2011.

Methods: Retrospective cross-sectional study using data of 90 patients who attend the dialysis and nephrology outpatients and using several doses of ESAs between November 2013 and April 2014 .Data collected through check list include also basic demographic information, disease stage, first and last hemoglobin level, type of ESAs, appropriate weight based dosing, appropriate initiation of ESAs, appropriate monitoring of hemoglobin , appropriate adjustment of the ESAs dose when hemoglobin level reached 11.5 mg/dl, appropriate rout of administration and concurrent administration of iron supplement. The study is done in Al Khor Hospital, a member of Hamad Medical Corporation, in Qatar and got the approval from IRB

Results: Of 94 patients who received several doses of ESAs and met the inclusion criteria, 90 (95.7%) were recruited in this study. Of those excluded, two were diagnosed with cancer, and two were reported dead during the study period. The prescribing preference between Erythropoietin and Darbepoietin is almost equal 57.1% and 42.9 % respectively. Most of the patients initiated ESAs treatment when their hemoglobin Hgb level greater than 10 mg/dl (65.6%) which is not recommended by guidelines. Weight based dosing was applied for 33 patients only (36.7%).Most of the patients (84.4 %) have checked for hemoglobin Hgb level at weekly basis, while 86.7% didnt have dose adjustment after each checking if needed. This explained why more than half of the patients (57.8%) have Hgb level at the end greater than 11.5gm/dl. Addition of Iron supplement and using correct route of administration were according to guidelines in 73 patients (81.1%) and 71 (78.9%) respectively. All the patients were not provided with Medication Guide. Overall, patients met 43% of the 8th met/ unmet criteria where 57 % of the criteria is unmet.

Conclusion: The findings showed suboptimal prescribing of ESAs for CKD patients in Al Khor Hospital .Overcorrection of anaemia is common in the Hospital. Further studies needed to assess if developing internal protocols for prescribing and increase the role of pharmacist will ensure optimal prescribing and monitoring and have better impact in patients care.

4-053

Category: Drug-Use Evaluation

Title: Evaluation of the safety, efficacy and utilization of a biologic product, tbo-filgrastim, in a community hospital: five-month analysis.

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Purpose: The biologic product, tbo-filgrastim, was added to our health system's formulary as a first line agent, over filgrastim, for a majority of patients presenting with neutropenia. A retrospective medication use evaluation was conducted to evaluate the utilization (label and off-label indications) of tbo-filgrastim. This review also included the safety and efficacy profile of this biologic medication, more specifically--assessing appropriate dosing and monitoring parameters by physician and pharmacy staff. Monitoring is recommended by the National Comprehensive Cancer Network in relation to the use of biologic products in cancer patients.

Methods: This medication use evaluation consisted of a retrospective chart review of 40 tbo-filgrastim orders for patients admitted to a community hospital. Orders were identified through a tbo-filgrastim order report from December 2014 to April 2015. Orders were included based on the following inclusion criteria: patients greater than or equal to 18 years old, admission to the community hospital, and at least one dose of tbo-filgrastim administered during admission. Orders were excluded if patients were less than 18 years old, were not administered tbo-filgrastim during admission, if the patient expired during admission, or inability to access patient records. Data was accessed using electronic medical records and information was collected using a data collection form. Background information was collected to assist in describing and analyzing pertinent data and the patient population of this study.

Results: Forty orders were initiated for neutropenia based on the following indications: 26 orders for myelosuppresive chemotherapy in non-myeloid malignancy, six orders for non-cancer related indications, and eight orders for acute myeloid leukemia. The average duration of severe neutropenia was 2.16 days overall and more specifically 1.38 days for patients with solid cancers. The mean time to absolute neutrophil count recovery was 2.82 days overall and more specifically 2.38 days for patients with solid cancers. The average days until the patient was no longer considered neutropenic was 2.61 days overall and more specifically two days for solid cancer patients. Seven orders did not require rounding and were appropriate for the nearest prefilled syringe selected, leaving 33 orders to be evaluated for rounding appropriateness. Of these, 12 orders were dispensed with the appropriate prefilled syringe and 21 orders were dispensed with the inappropriate syringe. For monitoring parameters during tbo-filgrastim administration, 37 orders had completed labs (complete blood count with differential and

platelets at least twice weekly) and 32 orders had daily absolute neutrophil count levels. Zero orders were documented as having immunogenicity or allergic reactions.

Conclusion: The use of tbo-filgrastim in patients in a community hospital is considered to be safe and efficacious in patients to reduce the duration of neutropenia and risk of neutropenic fever. Pharmacists can provide meaningful services in relation to the use of this biologic product. Such services include: pharmacovigilance for safety and efficacy, verification of appropriate weight-based dosing and duration of therapy.

4-054

Category: Drug-Use Evaluation

Title: Drug use pattern and evaluation of Non-benzodiazepine in a municipal hospital in Taiwan

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Purpose: Sleep disorders are common health problem of the modernized society. Medications for treating insomnia can be categorized into the benzodiazepine (BZD) group and the non-BZD group. Non-BZD drug has shorter sleep induction time, shorter half-life, less sleep cycle altering effect, and is less likely to develop drug tolerance and dependency. The goal of this study is to collect the usage data of non-BZD drugs in the treatment of insomnia in a municipal hospital in Taiwan. Data would be analyzed to access the amount of prescriptions and whether prescriptions were ordered appropriately to ensure patient safety.

Methods: Data were collected on the usage of Zopiclone, Zolpidem and Zaleplon (non-BZDs) from a municipal hospital in Taiwan during 2014. Descriptive statistics were applied in analyzing the usage of non-BZDs based on features such as patient number size, age, gender, prescribers specialty, valid indication, the frequency of prescribing refills, and the direction of use for the prescription.

Results: A total of 2109 prescriptions for Zopiclone, Zolpidem and Zaleplon were ordered in this study period. Zopiclone were ordered the most for a total of 1201 prescriptions (56.9%), the second was Zaleplon (26.4%), and the last was Zolpidem (16.7%). There were more females than male patients, refill prescriptions accounted for 71% of the prescriptions, 79% of the prescriptions were ordered to be taken at bedtime. Only 55.6% of patients had an appropriate sleeping disorder related diagnosis. Analyzing the data based on prescribers specialties, we found Zopiclone was ordered mostly by cardiologists (25%), followed by psychiatrists (22%), and infectious disease doctor (12%); Zolpidem was ordered mostly by psychiatrist (37%), followed by cardiologists (19%), and neurologists (17%); Zaleplon was ordered mostly by psychiatrist (20%), followed by cardiologists (17%), and endocrinologists (13%). About the age distribution of the patients, patients who received Zopiclone was mostly between 60 to 69 years of age whereas the age range for Zolpidem and Zaleplon was between 50 to 59 years of age. The percentage of patients who received higher than the recommended daily dose for Zopiclone, Zolpidem and Zaleplon was 11%, 23% and 6%, respectively.

Conclusion: The result showed 71% of prescriptions for sedatives were for refills indicating sleeping disorder is a long term condition for many people. The study also showed only 55.6% of sedative prescriptions was ordered for patients who had a confirmed sleeping disorder diagnosis. Hence, pharmacists play an important role in evaluating the appropriateness of the sedative prescription, providing patient counseling on the correct method of taking sedatives, educating patients on ways of maintaining a good sleeping hygiene, and lastly, safeguarding drug safety for the patient.

4-055

Category: Drug-Use Evaluation

Title: Drug use evaluation of anticoagulants in atrial fibrillation patients in a municipal hospital in Taiwan

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Purpose: According to the American Heart Association (AHA) recommendations, atrial fibrillation (AF) is a high risk factor for storke. Appropriate use of oral anticoagulants can effectively reduce the occurrences of ischemic stroke by as much as 60%. This study was to examine the usage of oral anticoagulants in AF patients who were seen in the out-patient clinics in a municipal hospital in Taiwan.

Methods: The data was collected retrospectively from the hospital computer system. The patients who had visited the out-patient clinics between January to Mach of 2014, and had a confirmed diagnosis of atrial fibrillation were included. Basic information collected were the name, age, gender, diagnosis, specialist visited, past medical history, and the history of oral anticoagulant uses. In addition, patients were divided into the low risk, moderate risk, and the high risk group by the CHADS2 risk score according the guideline provided by the Taiwan Stroke Society and the usage of oral anticoagulants in these groups were studied.

Results: There were a total of 182 patients enrolled in the study. 106 patients were male (58.2%) and 76 patients were female (41.8%). The average age was 74.5 years old and 54.9% of patients were older than 75 years old. There were 130 people (71.4%) fell into the high risk group, 42 people (23.1%) in the moderate risk group and 10 people (5.5%) in the low risk group. In the moderate to high risk group, there were 14 patients (8.1%) who had received oral anticoagulants for stroke prevention, and 13 of them received warfarin and one received dabigatran. In the same risk group, there were 115 patients (66.9%) who were prescribed antiplatelet agent (aspirin or clopidogrel) and 43 people (25%) were untreated. In the moderate to high risk group, of the 13 people who were prescribed warfarin, there were three people who did not have regular International Normalized Ratio (INR) monitoring and their average INR value was 1.39. There were 32 enrolled patients hospitalized and two patients were hospitalized due to ischemic stroke. Among the low stroke risk group, the ratio between people who were treated with aspirin to the untreated was about one to one.

Conclusion: There were only 8.1% of patients in the moderate to high risk group who were on warfarin or dabigatran; moreover, none of the patients who were on warfarin had achieved INR

value in the desired target range between 2 to3. However, the general treatment plan for the low risk group was in line with the current guideline. Pharmacist can play an active role in the stroke prevention by evaluating the appropriateness and the necessity of oral anticoagulant; thus, assisting physician in making an appropriate clinical decision to reduce the rate of stroke and lessen the medical expenses.

4-056

Category: Drug-Use Evaluation

Title: Drug utilization evaluation on enoxaparin in venous thromboembolism prophylaxis for total hip and knee replacement surgery

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Purpose: This study aims to evaluate the appropriateness of use of enoxaparin in total knee and hip replacement (TKR and THR) surgery patients at National University Hospital (NUH), a 991-bed teaching hospital in Singapore. Henceforth, potential gaps in prescribing practices and possible adverse clinical events associated with enoxaparin usage can be identified and revealed.

Methods: A retrospective, cross-sectional study was performed to all patients who have undergone TKR and/or THR surgery in a 5-month period from 1st January to 31st May 2013 at NUH. Data was extracted from electronic medical records and case notes. Process indicators included appropriateness of use of enoxaparin in terms of dose, frequency, indication, contraindications, duration of drug administration and time of first dose initiation. Outcome indicators were clinical events including venous thromboembolism (VTE) and hemorrhagic events in a 3-months follow-up period post surgery.

Results: A total of 82 patients were available for evaluation. Chemoprophylaxis prescribing patterns for only 46 (56.1%) patients were compliant to NUH guidelines in terms of indication. 55 (67.1%) patients require chemoprophylaxis but only 30 (36.6%) patients were given enoxaparin. None of the prescribed enoxaparin dosing regimens were compliant to NUH guidelines in all aspects of dose and frequency, prophylaxis duration and time of first dose initiation. There were no bleeding events due to enoxaparin during the 3 months follow-up. 9 (11.0%) patients developed thrombosis, 2 of which were considered clinically significant by physicians.

Conclusion: This study established baseline usage patterns of enoxaparin in NUH TKR and THR patients. Under chemoprophylaxis was detected. The adverse clinical events that occurred highlighted safety gaps within prescribing practices, for which recommendations were made to improve the safe and effective use of VTE chemoprophylaxis in NUH post-surgical orthopedic patients.

4-057

Category: Drug-Use Evaluation

Title: Evaluation of vancomycin trough concentrations in elderly patients weighing 55 kg or less

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Purpose: Guidelines recommend weight based dosing of vancomycin at 15-20 mg/kg/dose using actual body weight for adult patients to achieve trough concentrations of 15-20 mcg/mL. It is also suggested that a vancomycin loading dose of 25-30 mg/kg should be given for serious infections. Currently there are no specific recommendations for elderly patients. The purpose of this study was to determine the percentage of elderly patients weighing 55 kg or less who achieved initial therapeutic steady state vancomycin trough concentrations using guideline recommended dosing.

Methods: This was a single center, retrospective chart review conducted in a 200 bed community hospital from January 1, 2013 to May 31, 2015. Patients 65 years and older were included if they weighed 55 kg or less, received vancomycin dosed per institution protocol, and had a steady state vancomycin trough concentration during admission. Patients were excluded if they received vancomycin dosed at less than 15 mg/kg, if the dosing interval was inappropriate based on estimated creatinine clearance and half-life, or if vancomycin was administered prior to admission. Age, gender, weight, ideal body weight, serum creatinine, creatinine clearance, vancomycin indication, vancomycin dosing regimen, and initial vancomycin trough concentrations were collected.

Results: A total of 53 patients receiving vancomycin with documented trough concentrations met the age and weight requirements for the study. Twenty four patients met exclusion criteria, leaving 29 patients to be evaluated. The mean patient age was 77.2 years (range of 65 to 91 years) and 83% were female. The mean patient weight was 50.7 kg (range 33.6 to 54.9 kg). Of the 29 patients included, 7% (n=2) had an initial vancomycin trough concentration in the goal range of 15-20 mcg/mL, 86% (n=25) were subtherapeutic, and 7% (n=2) were supratherapeutic. The mean maintenance dose was 20 mg/kg (range 15.1 to 25.4 mg/kg). Loading doses were given to 100% (n=2) of patients in the therapeutic group, 56% (n=14) in the subtherapeutic group, and 100% (n=2) in the supratherapeutic group. The mean loading dose was 24.9 mg/kg (range 20.2 to 29.8 mg/kg).

Conclusion: The current institutional vancomycin dosing protocol is based on guideline recommendations. Eighty six percent of elderly patients weighing 55 kg or less failed to achieve initial therapeutic steady state vancomycin trough concentrations when dosed per protocol. Modifications of the current protocol should be considered to avoid subtherapeutic vancomycin concentrations in this population. Further examination into vancomycin dosing for the elderly, including those weighing greater than 55 kg is needed.

4-058

Category: Drug-Use Evaluation

Title: Evaluating the Ability of Testosterone Undecanoate to Maintain Testosterone Levels within Physiological Ranges, in Hypogonadal Men, and Investigating the Significance of its Acute Adverse Effects

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Purpose: Testosterone hormone replacement therapy, is the main treatment of testosterone deficiency resulting from hypogonadism. Testosterone intramuscular formulations should be administered every 2 to 3 weeks and are known to rapidly increase total testosterone serum levels (TSL) into supra-physiological ranges then decline to hypo-gonadal ranges. It's claimed that intramuscular testosterone Undecanoate (TU) formulation increases TSL to stable physiological ranges (i.e. no fluctuations), and maintains it with around 4 injections per year (i.e. better compliance). Acute pulmonary oil micro-embolism (POME) reactions and/or acute anaphylaxis were reported, post-marketing, directly following TU injections. Our study will evaluate TU for stable levels and safety issues.

Methods: We conducted a retrospective study. All men, at Hamad General Hospital (HGH), who were being treated, regularly, with TU, for their testosterone deficiency, since January 2012 to December 2014, were included. HGH patients have all their laboratory tests, medications, medications administration dates and any corresponding adverse effects, accurately recorded on the hospital electronic information system and patients medical records manual files. These medical information sources can be accessed securely by the HGH health care providers, and were used by our study to fill a TU data collection sheet. The TU Data Collection Sheet included patients date of initiation of treatment (DIT), age at DIT and testosterone serum levels taken and their corresponding dates, within the study period. The injections dates, dosing intervals and acute serious adverse effects (anaphylaxis or severe coughing or other respiratory issues resulting from POME) which occurred to the patients directly following injection of TU were also recorded. For ethical purposes, any data that relates the collected information to the patients were not recorded. From the data collection sheet, the mean TSL, the mean dosing interval for all regularly taken measures and the acute serious adverse effects were analyzed using the One Sample T-Test.

Results: For 114 males (mean age at DIT was 52.44), with hypogonadism who were included in our study, treating with TU regularly was able to significantly maintain TSL within the normal physiological ranges. The mean TSL was 15.35 +/- 2.9 nmol/L ($P < 0.001$). This resulting mean TSL is, in general, in the lower third of the normal range, this is because Levels are usually withdrawn prior to the next dose. These levels were achieved with a mean dosing interval of 14.17 +/- 1.2 weeks ($P < 0.001$). The mean dosing interval indicates that normal levels are

achievable even with less than 4 injections per year. Directly after the intramuscular injections of TU, no incidents of anaphylaxis happened, while there were some POME reactions which occurred, but were insignificant (mean percentage of POME reactions was 2.31 +/- 0.5 %, $P < 0.3$).

Conclusion: The larger the ester size of a testosterone formulation, the longer the duration of action and more time is needed for the hormone to become active, post administration. Undecanoate-ester of the TU is larger than the esters of all other testosterone formulations, therefore, theoretically and as shown in our study, TU maintains testosterone levels within the normal physiological range for a longer period of time and without having high fluctuations in peaks and troughs. Although there are recommendations to observe a patient, for 30 minutes, following injection, our study showed that acute serious adverse effects (POME and/or anaphylaxis) are insignificant.

4-059

Category: Drug-Use Evaluation

Title: Evaluation Of Stress Ulcer Prophylaxis Use At A Community Hospital

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Purpose: Inappropriate use of medications to prevent stress ulcer prophylaxis (SUP) exposes the patient to unnecessary risk for developing adverse drug events such as Clostrium difficile infections, pneumonia, and drug interactions. Tenet Healthcare has adopted the Choosing Wisely campaign from the Society of Hospital Medicine and is encouraging all of their inpatient facilities to perform a drug use evaluation on SUP. The primary objective of our evaluation is to determine the appropriateness of SUP at our facility. Our secondary objective is to determine trends in prescribing and try to identify interventions that can be made by pharmacy to improve appropriate prescribing.

Methods: A retrospective chart review was performed on patients receiving famotidine or pantoprazole for SUP between January 1, 2015 and January 23, 2015 at Doctors Hospital at White Rock Lake. Patients were excluded from the study if they were taking the same class of medications at home or if they had a documented indication for use. Data collected included demographics, home medications, indication for use, ventilator status, prescriber, ICU length of stay, nutritional status, and discharge medications. The names of the physicians were blinded to protect their privacy. The ASHP SUP guidelines were used to determine appropriateness. SUP is indicated in patients who have one or more of the following risk factors: mechanically ventilated for ≥ 48 hours, coagulopathy (defined as platelet count <50,000 per m3, an INR >1.5, or a partial thromboplastin time >2 times the control value), history of GI ulceration or bleeding within the past year, traumatic brain injury, traumatic spinal cord injury, or severe burns. SUP is also indicated in patients who have two or more of the following minor risk factors: sepsis, ICU admission lasting >1 week, occult GI bleeding lasting ≥6 days, and/or high-dose glucocorticoid therapy (more than 250 mg hydrocortisone or the equivalent).

Results: A total of 359 patients received famotidine or pantoprazole during the time period. Data from 139 patients were reviewed and analyzed after exclusion criteria. Of the 139 patients, 50 (36%) were male and 89 (64%) were female, and the mean age was 65 years. There were 46 (33.1%) appropriate and 93 (66.9%) inappropriate orders for stress ulcer prophylaxis. Out of the 46 patients indicated for SUP, 16 (34.8%) were for history of GI bleed/ulceration within the past year, 15 (32.6%) for coagulopathy, 8 (17.4%) for traumatic brain/spinal cord injury, and 5 (10.9%) for mechanical ventilation ≥ 48 hours, and 2 (4.3%) with sepsis plus high dose glucocorticoid. We found that 32 of the 93 patients prescribed SUP inappropriately were sent home with a prescription for acid suppressive therapy. Physicians US (22), FN (14), SA (11), MF (5), JF (11), SV (9), SS (8), and CL(7) had the most total orders. Physician JF had the most

inappropriate to total order ratio with 10 of 11 orders (90.1%), followed by physicians, SV (8 or 88.9%), SA (8 or 72.7%), UF (15 or 68.2%) and FN (7 or 50%).

Conclusion: Based on our findings, we have concluded that there are improvements to be made in the appropriate prescribing of stress ulcer prophylaxis among our patient population. Recently, the Pharmacy &Therapeutics committee approved a point based protocol for determining the appropriateness of SUP in patients. The protocol will be used when a pharmacist is verifying orders, performing daily rounding, or by a physician as a reference prior to initiating stress ulcer prophylaxis. After educating our healthcare professionals and initiation of our protocol, we will perform a repeat drug use evaluation in approximately 3 to 6 months.

4-060

Category: Drug-Use Evaluation

Title: Occluded PICC? Who ya gonna call?

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Purpose: From 2013 to March 2015, increased use of 2 mg alteplase vials was noted, from 1500 vials to 2700 vials. Our current line occlusion policy allows for a maximum of 2 doses of alteplase to be given. Alteplase is used on a daily basis as a first line option for treating line occlusion. We conducted this evaluation to determine if our policy was being followed, potential causes for increased use of alteplase, and outcomes related to use.

Methods: A retrospective evaluation of alteplase usage for central line management was performed at Childrens Healthcare of Atlanta (Egleston and Scottish Rite campuses) for patients receiving alteplase from October 1 2014 through March 31 2015 (6 months). Data collected included patient name, alteplase administrations, line type, age of line, medications administered, outpatient vs inpatient use, and outcomes per episode of alteplase use (line clearance vs line removal), and line days for 2013 to March 2015.

Results: A total of 437 patients were identified. A random sample of 52 patients was included in the evaluation, for a total of 66 hospital encounters, with equal representation at both campuses. The majority of patients had one hospital encounter. A total of 82 episodes of attempted line clearance were evaluated. Seventy-seven percent of doses were used inpatient. Sixty-eight percent of patients received 1 dose per episode of line clearance, followed by 28% receiving 2 doses. Sixty percent of lines cleared after 1 dose, and additional 11% after 2 doses and 17% had the line removed or replaced. Three patients received 3 doses. Review of line removals and replacements did not identify a common cause.

Conclusion: Alteplase use appears to be following our dosing protocol. There was no common denominator for issues that caused removal of the line, such as incompatible medications. Line days did increase from 42,217 in 2013 to 44,579 in 2014.

4-061

Category: Drug-Use Evaluation

Title: Intravenous iron use evaluation in an academic teaching institution: a bridge to formulary change

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Purpose: Several intravenous (IV) iron preparations are currently available with another one recently approved in 2013. All IV iron products carry administration precautions including infusion related reactions, hypersensitivity reactions including anaphylaxis, and changes in blood pressure, some with greater risk than others. Our institution formulary designates ferumoxytol (Feraheme) for outpatient use, iron sucrose (Venofer) for inpatient, and iron dextran (Infed) for both inpatient and outpatient use. The objective of this review was to determine if the appropriate IV iron product was being used in the appropriate clinical setting and to also evaluate the dosing, indication, and safety of the products used.

Methods: A retrospective electronic chart review was conducted over a six month period. Patients who had received at least one dose of an IV iron product were included. Existing hospital formulary was used to determine the appropriate agent for each clinical setting: ferumoxytol for outpatient, iron sucrose for inpatient, and iron dextran for either. Appropriate doses for iron sucrose were 100mg, 200mg, or 300mg and cumulative doses over 1000mg were considered inappropriate. The appropriate dose of ferumoxytol was 510mg on 2 separate encounters for a total of 1020mg, and the appropriate dose for iron dextan was considered to be 1000mg. Additionally, we collected indication for use for iron sucrose and any documentation regarding infusion related adverse reactions for the 3 IV iron products used.

Results: One hundred and twenty seven patients were identified. Of those, 1 patient received iron dextran as an outpatient (100 percent appropriate), 25 patients received ferumoxytol as an outpatient (100 percent appropriate), and 101 patients received iron sucrose, 75 of those as an inpatient (74.25 percent appropriate). Dosing was appropriate for the iron dextran group. Dosing was appropriate for 60 percent of the ferumoxytol group in that they received a total of 2 doses. Dosing was appropriate for 97 percent of the iron sucrose group, with doses ranging from 100mg to 300mg. The most common indication for iron sucrose was anemia associated with pregnancy and iron deficiency anemia being second. There were no documented infusion related adverse reactions in any of the groups. Limitations to this review included poor documentation of indication for IV iron as well as the potential for doses given outside of the study period to not be accounted for in the total dosing regimens.

Conclusion: A review of the available formulary IV iron products revealed inappropriate use of iron sucrose in the outpatient setting. Because of this, a drug class review will be completed to

evaluate the most appropriate IV iron formulation for inpatient and outpatient use based on cost, ease of administration and patient safety. Also, due to complicated dosing, safety concerns associated with administration, and low utilization, it was recommended to remove iron dextran from formulary.

4-062

Category: Drug-Use Evaluation

Title: The assessment of phosphodiesterase 5 (PDE5) inhibitor abuse among men in the Lebanese community: the development of a tentative diagnostic tool

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Purpose: Alcohol and substance abuse are currently clearly assessed by a variety of diagnostic tests such as the Michigan Alcohol Screening Test (MAST) and the DSM 5 Criteria for Substance Use Disorders. Even though PDE5 inhibitor abuse potential has been recognized, there is no conclusive definition for this specific type of abuse. Moreover, no definitive criteria specific to PDE5 inhibitors exist to classify subjects as abusers or not. The researchers aim to define a set of criteria, accompanied with a score in order to assess the abuse of PDE5 inhibitors in the Lebanese community.

Methods: A search was conducted on MEDLINE using the keywords: phosphodiesterase 5 inhibitors, diagnostic criteria, abuse, assessment and substance. It was necessary to check for the availability of such a tool prior to developing one. Furthermore the individual drug monograph of each PDE5 inhibitor was carefully assessed in order to define the appropriate usage and indication for use of these agents. Following an extensive literature review, the authors were able to propose a set of criteria for the assessment of agent abuse according to their correct use. Criteria chosen were based on demographic and epidemiological data collected as well as on behavioral patterns observed among abusers. The former includes concomitant intake of the agents with illicit substance (marijuana, ecstasy, methamphetamine etc.) which contributes to their abuse. Other psycho-social circumstances were taken into account while conducting the literature review.

Results: The authors identified two major criteria and three minor criteria for abuse. The first major criterion included age below 40 years, as only 2 percent of these men have clinical erectile dysfunction. The second criterion is incorrect indication, defined as any reason for use other than the FDA approved indications. The minor criteria included inappropriate usage of the product i.e. wrongful administration according to the indication, concomitant substance use, and consistency of usage with the sexual activity. The last criterion depicts the need for the abuser to use the product prior to each sexual encounter in the absence of a compelling indication. An individual is classified as an abuser if the following is met: 2 major criteria, 1 major and 2 minor, or 3 minor criteria. Alternatively, a score can be drawn from the criteria. A score of 3 is appointed to each major criterion and 2 for each minor. The score was then clearly defined. A total of 0-3 exempts

the individual from abuse while a total of 4-5 places the individual at a high risk for abuse. A score more than or equal to 6 classifies the individual as an abuser.

Conclusion: This diagnostic tool was developed in order to facilitate the assessment of PDE5 inhibitor abuse. The tool requires further validation and statistical analysis in order to be accepted and used on an international level. Criteria defined were based on observational and epidemiological patterns of men who take these agents to enhance their sexual activity. Many psycho-social factors contribute to the abuse of the products. The tool is suggested to be further tested and utilized in studies that aim to document the abuse of PDE5 inhibitors in the Lebanese community.

4-063

Category: Emergency Medicine / Emergency Room

Title: Safety of Ketamine for Procedural Sedation in a Low Resource Hospital

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Purpose: The primary objective of this study was to describe ketamine induced procedural sedation and report any adverse effect in a low resource hospital in Dar es Salaam, Tanzania.

Methods: This was an observational study of ketamine use and associated adverse drug events during procedural sedation at the Muhimbili National Hospital (MNH) Emergency Department. Data was collected via direct observation while research assistants were present in the department (~11am-7pm). All research assistants were trained in the data collection protocol prior to the beginning of the study. Vital signs were taken before, during, and after each procedure at 5-minute intervals until the patient fully recovered or there was a transfer of care. A handheld Novametrix Model 710/715 Capnograph device was used to capture all vital signs necessary for the study with the exception of blood pressure, which was performed with local monitors or manually. Additional data points of interest were: patient demographics, reasons for ketamine, duration of emergency department stay, adverse events, and 3-question patient and provider satisfaction survey. Adverse events were defined a priory using existing consensus guidelines. Clinicians at MNH were blinded to the vital signs during procedures to simulate every-day practice. However, our researchers were able to de-blind the study if predefined safety parameters were observed. All data is described using descriptive statistics. This study was IRB approved at MNH and sponsoring institution Univeristy of California San Francisco.

Results: We observed a total of 47 pediatric and 38 adult patients. Ketamine was most frequently given via intravenous route (88%) with an average induction dose of 1 and 1.4 mg/kg in adults and kids, respectively. Overall ketamine was well tolerated and resulted in high patient satisfaction. Three patients vomited, five experienced nausea, however no patient experienced hypotension or bradycardia, exhibited a paradoxical reaction, had an unpleasant recovery or permanent complications. There were nine patients who met a priory criteria for an adverse event (oxygen saturation below 92%). The treating physicians attributed the desaturations to the underlying patient condition (e.g., pneumothorax) and did not believe the use of ketamine led to additional complications. Most providers (98%) felt comfortable using ketamine for procedures and would consider using ketamine again in the future.

Conclusion: The use of ketamine for procedural sedation in a low resource emergency department at MNH is similar to the use of ketamine in resource rich countries. No adverse events occurred that were attributed to the use of ketamine. The use of ketamine resulted in high satisfaction scores in providers and patients. Our patient cohort comes from a single center and may have been too small to detect rare adverse events. Larger studies are needed to confirm the safety of ketamine in resource poor settings.

4-064

Category: Emergency Medicine / Emergency Room

Title: Interventions generated by clinical pharmacy services in the emergency department during the first year of implementation

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Purpose: Providing clinical pharmacy services in the emergency department is being recognized more and more as an integral part of providing optimal safe and effective patient care in this fast paced environment. To initiate such services in our institution, a full time clinical pharmacy specialist was hired to be stationed in the emergency department and be part of the interdisciplinary team of health care practitioners providing direct patient care. An analysis was conducted of the number and type of interventions made by this clinician during the first year of the service.

Methods: Clinical pharmacy services were initiated in the emergency department of a university teaching hospital that contains 54 beds and processes approximately 65,000 visits per year. One clinical pharmacist provided coverage from 3:30 P.M. to 12:00 A.M. 5 days a week (excluding weekends and holidays). Number and type of interventions made were documented on a tally sheet and entered in the Medkeeper electronic pharmacy documentation system on a weekly basis. This database was then queried for the number and type of interventions made during the first year of pharmacy presence in the emergency department. Intervention categories were further grouped under more encompassing intervention classifications such as: adherence to formulary, assistance with core measures, avoidance of inappropriate therapy (with regard to dose, frequency, route, et cetera), clarification of incomplete/ambiguous orders, drug information, medication reconciliation, operational assistance (which included participation in codes and facilitation of timely drug provision), patient specific consultation, prevention of adverse events/drug interactions, and other interventions. An analysis was done with regards to which type of interventions predominated.

Results: A total of 3570 interventions were documented in the first year of services. The most frequent type of interventions dealt with medication reconciliation (20.6 percent) and operational assistance (19.8 percent). A significant number of interventions dealt with clarification of incomplete or ambiguous orders (15.6 percent), avoidance of inappropriate therapy (12.0 percent) and provision of drug information (10.3 percent). Interventions to change therapy in order to adhere to hospital formulary comprised 8.8 percent of total interventions. Renal dose adjustments, patient specific consultations, assistance with core measures, and prevention of adverse events/drug interactions were 3.8 percent, 3.7 percent, 2.0 percent and 0.6 percent respectively.

Conclusion: A clinical pharmacy specialist in the emergency department can significantly contribute to the provision of safe, effective, and efficient patient care. Areas where involvement was predominant were medication reconciliation and assistance with operational activities. Safe and effective pharmaceutical care is further improved by the proactive and timely review of medication orders and consultations with other health care practitioners.

4-065

Category: Emergency Medicine / Emergency Room

Title: Organized chaos: precepting in a community hospital emergency department

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Purpose: Emergency departments (ED) have a dynamic unlike any other unit in a hospital. Patients are constantly improving, declining, moving, stabilizing, discharging or being admitted. Pharmacy presence in EDs is sparse throughout the country and seasoned preceptors in established programs are even more uncommon. The intention of this information is to provide our organized approach to precepting students and residents, in a community hospital ED, for other institutions to successfully initiate or improve their own programs.

Methods: To prepare the learner for the best possible emergency medicine (EM) experience, the primary preceptor sends out several documents for review prior to the rotation. This includes learning experience outline and expectations, relevant primary literature and rotation schedule. Acknowledgement of the receipt of documents is requested to ensure baseline expectations are understood. Orientation includes review of the aforementioned documents and familiarization with commonly used EM pharmacy resources. Introduction of staff, computer system and physical space in the inpatient pharmacy and the ED is also provided. Communication of typical ED experiences is vital for rotation success. A learning environment with high volume verbal orders, unpredictable patient presentations and multiple rapid physician questions where the learner has few correct answers is daunting. Acknowledging the inconsistencies, volatility, emotions and varying professionalism is important for learners potentially uncomfortable in that setting. Consistent, on-the-spot feedback with each interaction is important to close loops and ensure the environment is not overwhelming.

Results: Mercy Hospitals EM dedicated pharmacy service was established in 2007 along with an elective residency rotation. The student rotation was added in 2010. Twelve students and twenty-four residents have successfully completed the rotation since implementation. The solid structure of the rotation has enabled learners of vastly different skill levels and interests to have success in this unique rotation experience. Our residency program changed the EM rotation to required as the demand has significantly increased and residents are seeking out our program specifically for the ED rotation. The pharmacist that initiated the EM program & rotation was also awarded Preceptor of the Year from the Minnesota College of Pharmacy in 2011.

Conclusion: An organized and consistent approach in preparing and orienting students/residents in an ED is necessary for success. Discussing the nuances and difficulties of the environment beforehand and maintaining purposeful communication throughout the experience has proven vital for the demands of the rotation. This rotation is a successful and sought after experience in learners of varying levels of education and EM interests. Pre-rotation exposure of content and expectations form the foundation with immediate feedback and consistent communication enhancing the learning and making the overall experience successful.

4-066

Category: Emergency Medicine / Emergency Room

Title: Intravenous lipid emulsion therapy for toxic ingestion of lipid-soluble medications: case series

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Purpose: Intravenous lipid emulsion (ILE) has emerged as a therapeutic option for the treatment of toxic ingestion of lipid-soluble medications. The rationale for the favorable effects of this therapy is based on the hypothetical lipid sink theory. In this series we review 6 cases of ILE use as supportive care in the emergency department (ED) and intensive care units (ICU) at our institution.

Methods: This is a retrospective case series of patients treated with ILE as part of the treatment regimen with known or potential ingestion of lethal doses of lipid-soluble medications at Mercy Hospital in Coon Rapids, MN from January 2012 to May 2015. Patients were treated utilizing a protocol adapted from the Hennepin Regional Poison Control Center in Minneapolis, MN. We reviewed lipid bolus and infusion dosages and duration, monitoring parameters, and additional supportive care measures for each case. Duration of hospitalization was also evaluated during our review.

Results: Six patients were treated with ILE during the specified time frame. Aspirin, atenolol and quetiapine were the primary toxicities; however, 3 cases involved polysubstance overdose (including ethanol, tramadol & antihypertensive agents). Standard therapy including intravenous (IV) fluid resuscitation, calcium gluconate, sodium bicarbonate, vasopressors and high dose insulin therapy were utilized in some cases; however, ILE was initiated in all 6 cases in an extended effort to avoid mortality. Mean time of ILE initiation from ED arrival was 128 minutes (range 42 to 248 minutes). In each case, patients received an average bolus dose of Lipid 20% of 1.28 ml/kg (range 0.8-1.5ml/kg) followed by an average continuous IV infusion of 0.21 ml/kg/min (range 0.21 0.25 ml/kg/min). Mean arterial pressure and systolic blood pressure were used as preliminary surrogate markers to measure CO in lieu of more invasive monitoring techniques and lack of available means to directly measure CO. All six patients required intubation and additional hemodynamic support with multiple vasopressors along with the ILE intervention. The mean duration of lipid infusion was 40 minutes (range 0 60 minutes). Two patients survived to hospital discharge and were neurologically intact with mean hospital stay (exclusive of psychiatric admission) of approximately 7.5 days.

Conclusion: ILE as therapy for toxic ingestions of lipid-soluble medications has been documented in animal models & case reports. Although the outcomes of the cases summarized

are inconclusive, earlier implementation of lipid therapy in these cases suggest improved outcomes. Limitations of our case series include retrospective nature of data, small sample size, and significant variation in implementation of additional therapies including vasopressor support. Further studies using this therapy and comparisons to standard therapy are still needed.

4-067

Category: Emergency Medicine / Emergency Room

Title: Angioedema After Intravenous Alteplase (tPA) Administration for Acute Ischemic Stroke

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Case Report: Introduction: Angioedema after intravenous recombinant tissue Plasminogen Activator (rt-PA) treatment for acute ischemic stroke is understudied due to a small number of reported events. However, this adverse reaction is considered life-threatening. Increased use of IV rt-PA therapy raises concerns and may expose patients on an angiotensin converting enzyme inhibitor (ACEI) to an increased risk of this rare adverse event due to the shared mechanism of action. Understanding the pathophysiology of angioedema related to rt-PA and ACEIs and evaluating its medical management is essential for avoiding poor outcomes related to rt-PA administration in these patients. Methods: Case report Results: A 66 year old woman taking lisinopril for hypertension was transported to the emergency department and treated with rt-PA for acute ischemic stroke. An hour after rt-PA infusion, she developed significant orolingual swelling. The patient was treated with antihistamines and corticosteroids shortly after. No visible improvements were detected after 10 minutes of close monitoring. Due to the patients severity of symptoms and lack of response to angioedema therapy, intubation was indicated. The patient was critically ill for an additional two days with slow symptom improvement before and was then discharged home on day 6. Conclusion Due to a rapid and unpredictable onset, orolingual angioedema (OA) related to rt-PA infusion for acute ischemic stroke can be life-threatening and presents a challenge for appropriate treatment and management. Generally, the risk of OA diminishes considerably once rt-PA infusion has finished; however, in the case of this patient, symptoms presented one hour after administration. Patient screening prior to rt-PA administration, serial assessments and prompt recognition of the signs and symptoms of OA, and proper medical management are imperative to successful treatment of these patients. Recognizing signs and symptoms of angioedema is critical in preventing secondary complications, and careful patient assessment should be recommended every 15 minutes during rt-PA infusion and may also be required after infusion. Once symptoms of OA have been established, any causative agents, including rt-PA, should be removed. Screening patients for ACE inhibitor use, a contributing risk factor to rt-PA related OA, may help to prevent and prepare for this potential life-threatening drug interaction. This particular patient presented with a slower onset of rt-PA induced OA, with a longer duration of recovery as compared to published case reports. This indicates that there is still paucity in data surrounding rt-PA-induced angioedema and its management.

4-068

Category: Emergency Medicine / Emergency Room

Title: Intravenous fluid resuscitation in severe sepsis and septic shock patients in the emergency department

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Purpose: Surviving Sepsis Campaign (SSC) guidelines recommend rapid intravenous (IV) infusion of a large volume of fluid in severe sepsis and septic shock patients: 30 mL per kilogram over one hour. IV fluid resuscitation with a crystalloid should be initiated within one hour when either lactic acid is greater than 4 mm per liter or systolic blood pressure (SBP) is less than 90 mm Hg in severe sepsis or there is a decrease in SBP greater than 40 mm Hg with no response to a fluid challenge in septic shock patients. Our goal was to identify IV fluid resuscitation guideline compliance.

Methods: A retrospective evaluation of IV fluid resuscitation was conducted. We measured IV fluid dosing and the time to administration of the IV fluid once severe sepsis or septic shock was identified. This study was approved by our Institutional Review Board (IRB). Patients included in the study were all emergency department (ED) patients 21 years of age and older who had been diagnosed with severe sepsis or septic shock and were subsequently admitted to the intensive care unit (ICU). Patients were identified by ICD9 codes. There were three phases: phase 1 was from April first to December thirty first, 2012; phase two was from February first to July thirty first, 2013; and phase three, a snapshot, was from January first to March fourteen, 2014. Between each phase there were multiple formal and informal educational interventions with ED prescribers and nursing staff which included lectures, ED newsletters articles, and study results discussions. The Chi Square test was used to detect a difference in proportion of patients receiving appropriate IV fluid dosing between all phases. The ANOVA test was used to detect a difference in appropriate time to IV fluid administration between all phases.

Results: There were forty five patients evaluated in 2012, forty one patients were evaluated in 2013 and ten patients (25 percent of population from previous studies) were evaluated in the 2014 snapshot. There was statistically significant improvement in appropriate IV fluid dosing, 30 mL per Kg, from 2012 (4.4 percent) to 2013 (36.6 percent) and to 2014 (100 percent), p less than 0.05. There was statistically significant improvement in time to IV fluid administration, within one hour of severe sepsis or septic shock identification, from 2012 (61.3 minutes) to 2013 (33.7 minutes), p equals 0.036. There was no statistically significant difference in time to administration between 2012 (61.3 minutes) and 2014 (39.5 minutes), p equals 0.32. However, in 2013 and 2014 time to administration of IV fluid was completed within one hour of identification of disease presentation and this was a clinically significant improvement.

Conclusion: Opportunity for improvement was identified. Compliance with the SSC resuscitation bundle guidelines for IV fluid administration in severe sepsis and septic shock patients was low on the initial phase; compliance improved in the second phase and it was sustained in the snapshot. Implementation of educational interventions over a 2 year period resulted in improved dosing and time to administration of IV fluids in severe sepsis and septic shock patients in our ED.

4-069

Category: General Clinical Practice

Title: Determining the optimal insulin regimen for glycemic control of hospitalized non- critical diabetic patients: a cross-sectional observational study

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Purpose: The hospital management of diabetic patients requires an easily implementable but effective insulin regimen, as this has a bearing on all treatment outcome measures. This single center cross-sectional, observational study aimed to evaluate the efficacy of insulin regimens over the course of a week in non-critically ill inpatient diabetics.

Methods: A total of 112 inpatients were recruited and categorized based on the insulin therapy into three regimen groups: sliding-scale regimen (SS), basal-bolus regimen (BB), and basal-plus correction regimen (BC). The daily blood glucose level (BGL) was monitored four times daily. Data of important covariates including co-morbidities, use of steroids, glycated hemoglobin (HbA1c), and demographics were also collected. The regimens were altered over the study period if required. To consider any change in the patients regimen type during the 8 days, the final analysis was projected in two ways for statistical evaluation. The first type was based on the type of therapy the patient received that day, making each day a data point. The second analysis was made based on categorizing each patient into one of the three regimens based on the type of regimen the patient received 70% or more of the time. The data has been analyzed using ANOVA, chi-square test of independence and regression analysis.

Results: There was no difference in baseline characteristics among groups except for home insulin regimen before admission .The first type of analysis revealed that the effect of baseline

(day 1 vs. day 2 to 8) was significant [p equals 0.036].However, there was no statistically significant difference among the treatment types on mean daily BGL at p less than 0.05 level [p equals 0.128]. Similarly, the second type of analysis yielded non-significant results [F (2, 18) equals 2.277, p equals 0.131]. Regression analysis showed that BC regimen is associated with 0.0127 units increase in the mean BGL when all the other independent variables are controlled while BB regimen and SS are associated with 0.364 and 1.592 units decline in the mean BGL respectively when all the other independent variables are controlled. Analysis of BGLs at daily particular measurement times showed that The mean BGL was significantly lower in patients received SS and BB than those administered BC at noon, evening and bedtime, [F(3,137) P equals 13.468, p less than .001]. Secondary endpoints were also analyzed to tease out differences among treatment groups in the frequency of hypoglycemia, hyperglycemia, as well as total daily dose of insulin.

Conclusion: In conclusion, the use of any of the three insulin regimens resulted in similar glycemic control among hospitalized non- critical diabetic patients. More randomized trial and large cohort studies are urged to show any difference on glycemic control among non-critical patients.

4-070

Category: General Clinical Practice

Title: The use of quality indicators to assess medication reconciliation process on admission

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Purpose: Medication reconciliation (MR) is effective to detect errors on admission. Previous work suggests that the overall compliance of hospitals with MR policy is lower than expected and that there are variations in the documentation of MR information between hospitals and pharmacists within the same hospitals. A standardised method is required to assess quality, improvement or the effect of any change on the MR process. Thirty-six MR indicators were found valid and feasible to be used for assessing the MR process in previous work. The aim of this study was to apply the MR indicators in two hospitals.

Methods: A MR data collection form was designed based on data required for the MR indicators assessed, modified and face validated. A cross sectional prospective design was used. Pharmacists in two UK hospitals conducting the MR process on admission were given a MR data collection form with instructions to complete the form. They were asked to complete the form for all patients admitted under their care during a selected days. The frequency of each indicator was calculated as a percentage. SPSS was used to analyse the data and chi-square was used to detect the potential correlations.

Results: In hospital A and B, 64 and 75 MR data collection forms were completed respectively. Formal MR process was conducted in both hospitals. In the two hospitals, 45% and 52% of patient admitted had their medication reconciled (81% and 85% were within 24 hours) in hospital A and B respectively. The average time taken to complete the MR process was 12.5 and 14.1 minutes in hospital A and B respectively. Drug allergy was checked in 92% of admissions in both hospitals. In hospital A, the OTC medicines and complementary (herbal) were checked in 81.3% and 79.7% respectively where in hospital B, 64% and 33.3% were checked respectively. GP and patient sources were the main sources used to collect drug history and patient interview was the highest source used (80% in both hospitals). Variation in checking medication adherence and intolerance was observed between pharmacists and they were checked more frequently in hospital A. Unintentional discrepancies were identified in 47% and 37% of the patients reconciled in hospital A and B respectively. Drug omission was the highest type of discrepancies followed by change in drug dose then addition in both hospitals. Patients over 60 years were significantly at higher risk for errors.

Conclusion: MR indicators were very useful to identify several MR aspects that could be improved. Strategies should be applied to increase the number of patients reconciled on admission and improve the MR process. The MR indicators could be used to evaluate the process, guide on the areas that need improvement and assess the effect of potential changes on the process.

4-071

Category: General Clinical Practice

Title: Comparison of resident strengths and strengths desired by preceptors based on the Clifton StrengthsFinder 2.0

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Purpose: Post-graduate pharmacy residencies are becoming more and more highly sought by graduating students, yet the number of available positions has not been increased commensurate with the increased demand. As a result, there is a greater number of qualified applicants per residency position, and residency program directors (RPDs) must develop more innovative ways to identify the candidates who best fit their program.

Methods: Thirty-two clinical pharmacist preceptors completed the Clifton StrengthsFinder 2.0 assessment as part of a preceptor development activity. Twenty-three (71.9%) of these individuals responded to a survey regarding the strengths which they would most desire in incoming pharmacy residents. The list of strengths, in order from most desired to least desired, was compared with the StrengthsFinder 2.0 results of all (n = 22) incoming pharmacy residents since July 2010.

Results: The top five most desired strengths identified by the preceptors included: learner (91.3%); responsibility (91.3%); communication (87%); achiever (69.6%); and discipline (56.5%). The top five most common strengths among the pharmacy residents were: learner (40.9%); harmony (40.9%); achiever (36.4%); developer (31.8%); and positivity (31.8%). Of the five strengths not chosen by any of the preceptors as desirable (command, deliberative, futuristic, significance, and strategic), two (command and significance) were not among any of the residents' top five strengths.

Conclusion: The results of the Clifton StrengthsFinder 2.0 assessment can assist residency programs in identifying strengths of current residents. This data, in turn, could be used to determine which strengths are most (or least) desirable in future residents. Strengths analysis could then be used to tailor the candidate application and/or interview process in an attempt to ultimately rank those candidates who best exemplify the traits most desired by the residency program. Our results will be used to determine what changes, if any, need to be made our current resident interview process.

4-072

Category: General Clinical Practice

Title: Implementation of a pharmacist driven stress ulcer prophylaxis discontinuation protocol in non critically ill patients in a community teaching hospital

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Purpose: Current guidelines and literature support the use of stress ulcer prophylaxis in critically ill patients, but routine use in their non-critically ill counterparts is not typically recommended due to the low reported incidence of stress ulcers in this population. Furthermore, the wide misuse of acid suppressive therapy has been associated with Clostridium difficile infections, community acquired pneumonia, and unnecessary hospital expenses. The objective of this study is to assess the impact of a pharmacist driven stress ulcer prophylaxis discontinuation protocol in adult patients admitted to a medical or surgical unit.

Methods: This prospective, evaluative study conducted between February and April 2015 received expedited institutional review board approval. Patients were enrolled into the study if they received intravenous or oral esomeprazole, famotidine, pantoprazole, or oral sucralfate. Appropriateness of therapy was based on a modification of the 1999 American Society of Health System Pharmacists stress ulcer prophylaxis guidelines. Patients were excluded if they received any acid suppressive therapy medications at home, were at moderate to high risk for antiplatelet or nonsteroidal anti-inflammatory drug-induced gastrointestinal bleeding, were admitted for an acute or suspected gastrointestinal bleed, or had a diagnosis of gastroesophageal reflux disease, esophagitis, peptic ulcer disease, or dyspepsia. The primary outcome of this study was to evaluate the number of discontinuations of inappropriate stress ulcer prophylaxis by pharmacy residents and clinical pharmacy generalists. Secondary outcomes assessed the number of intravenous to oral conversions in patients who were continued on stress ulcer prophylaxis therapy, incidence of nosocomial bleeding, and new onset Clostridium difficile infection. All outcomes were analyzed using descriptive statistics.

Results: There were a total of 220 patients assessed with 33 patients meeting criteria for study inclusion. A recommendation to discontinue therapy was made for 28 patients, 15 of which were accepted. In reviewing patients on therapy, it was found that 20 patients did not meet any risk factors for the development of stress ulcers. Reasons provided for continuation of therapy despite recommendations for discontinuation included nausea, alcoholism, continuation of a prior prescribers order, and clinical decision to continue therapy. There were no observed instances of new onset Clostridium difficile or nosocomial bleeding.

Conclusion: The implementation of a pharmacist driven stress ulcer prophylaxis discontinuation protocol reduced the total number of patients receiving inappropriate therapy. Although no adverse events were identified from continuing stress ulcer prophylaxis, judicious utilization of medications is still important. Evaluation of stress ulcer prophylaxis therapy in non critically ill patients may be incorporated into daily clinical generalist activities at our institution.

4-073

Category: General Clinical Practice

Title: Implementation of an inpatient bulk medications to home program at a large academic medical center

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Purpose: Partially-used multi-dose medications used by patients during hospitalization are discarded at the time of discharge in most hospitals, even if the patient will be continuing the medication following hospital discharge. A major obstacle preventing hospitals from sending home partially-used multi-dose medications is the need to comply with outpatient pharmacy-related requirements. We designed and implemented a Bulk Meds to Home Program for insulin and inhalers at our large academic medical center that meets regulatory requirements, and evaluated the impact of the Program on post-discharge medication access and patient satisfaction.

Methods: This project was approved by the hospital's quality improvement committee. Our informatics team designed a label containing information required on an outpatient prescription label as well as the inpatient barcode. All insulin and inhalers ordered for inpatient use are dispensed in a translucent pink plastic bag with this label. As per new hospital policy, if the discharging physician continues the medication during discharge medication reconciliation, then the nurse transfers the partially-used medication to the patient. A statement on the patient signature page of the discharge instructions prompts the nurse to provide the medication to the patient after offering pharmacist counseling. The patient circles yes or no on the signature page indicating whether they accept or decline the offer for pharmacist counseling, and the document is scanned into the medical record. To assess patient outcomes related to the Program, we focused on patients discharged to home on insulin pens. Patients discharged to home on insulin before and after implementation were contacted via telephone within 72 hours of discharge. Patients were questioned to determine when they filled their insulin prescriptions following discharge and their satisfaction with the insulin discharge process using a scale of 1 (not satisfied) to 5 (very satisfied).

Results: A pharmacist called 100 patients prior to implementation (Before) of the Bulk Meds to Home Program, and 100 patients after implementation (After). The number of patients who were given their partially-used insulin pen increased from 16% to 55% after implementation of the Program. When evaluating just patients newly started on insulin at discharge, 2/14 (14%) vs. 4/11 (36%) patients took their partially-used insulin pen home, and 9/14 (64%) vs. 7/11 (64%)

filled their new insulin prescription on the day of discharge in the Before and After groups, respectively. In the Before group, 3/14 (21%) did not have insulin for at least two days after discharge compared to 0 patients in the After group. Of 15 patients who had their prescription filled at an outside pharmacy (unaffiliated with the hospital) on the day of discharge, only 60% ranked their satisfaction with the process as a 4 (satisfied) or 5 (very satisfied). Of all 71 patients who took their partially-used insulin home from the hospital, 92% were satisfied or very satisfied with the insulin discharge process.

Conclusion: Implementation of a Bulk Meds to Home Program that adheres to all pharmacy regulations required coordinated effort of the IT team as well as staff nurses and pharmacists. The Program ensured patients had continued supply of medications at the time of hospital discharge which has the potential to increase medication adherence and improve patient outcome. In addition, patients who took their partially-used insulin home at discharge were more satisfied than patients who had to go to an outside pharmacy to fill their prescription. Based on these results, the Program has rolled out at our hospital to include other multi-dose medications.

4-074

Category: General Clinical Practice

Title: Advanced institutional learners as pharmacist extenders on a decentralized care team model

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Purpose: Baystate Medical Center is a 716-bed, academic institution in Springfield, Massachusetts that accepts advanced institutional learners from six area Pharm.D programs. In October 2014, the acute care pharmacy department adopted a decentralized model and divided nursing units into nine care teams. Learners were integrated into this model as additional clinical tasks were incorporated into pharmacist responsibilities. Patients receiving vancomycin required daily monitoring by the care team. Additionally, the hospital wide falls prevention initiative was supported by critical evaluation of orders placed for Beers Criteria medications. Lastly, the use of anticoagulants were assessed for potential therapeutic duplication.

Methods: For each six-week block, two advanced institutional learners were assigned to a surgical care team leader as their primary preceptor. The students were then integrated onto their own care team and worked in concert with a clinical pharmacist. One care team included a surgery floor with several telemetry beds and the medical intensive care unit. The second care team included an intercare telemetry surgery unit, the surgical intensive care unit and the neurosurgery intermediate care unit. The learners generated patient lists using Cerner Information Systems to monitor vancomycin, Beers Criteria patients and potential anticoagulant duplications. In addition, patients were evaluated for potential intravenous to oral medication conversion based on criteria supported by an established clinical operations policy. Each clinical task utilized a worksheet to document the students research.

Results: The learners presented their findings to the clinical care team pharmacist daily. Dose administration times, serum creatinine, white blood cell counts, and temperature were recorded daily for patients receiving vancomycin. The learner was responsible for speaking to the nurse regarding pending vancomycin troughs. In the event that a trough was reported, the pharmacist and student would discuss possible dose adjustments based on pharmacokinetics. In turn, the learner would contact the surgical or medical team assigned to the patient and make recommendations. The use of vancomycin for more than 48 hours without positive cultures was monitored and, in such cases, the antimicrobial stewardship pharmacist was contacted. For each patient included on the Beers Criteria report, the learner would suggest an alternative medication and support their decision with established guidelines. After a discussion with the clinical pharmacist, the learner contacted the medical team. The learners identified potential duplicate anticoagulation patients and made recommendations if required.

Conclusion: The use of advanced institutional learners to perform clinical tasks is mutually beneficial; it allows educational opportunities for the learner while the clinical pharmacist is afforded more time for patient profile review, prospective interventions and interdisciplinary plan of care discussions. It is important to develop worksheets to hold the learner accountable for their research. By requiring extensive documentation on these worksheets, the clinical pharmacist is able to better assess the validity of the information presented. This model also allows the learner to refine time management and interdisciplinary communication skills. The learners report the level of autonomy to be professionally satisfying.

4-075

Category: General Clinical Practice

Title: Aligning pharmacist intervention classification systems with medical convention: talking apples to apples with doctors and administrators

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Purpose: Historically, pharmacist interventions are classified according to the seven drug-related problems to facilitate medication-centric analysis of pharmacotherapy. However, this medication-centric focus often falls short in communicating value to physicians from a diagnosis-centric perspective or administrators from a systems-centric perspective. Although these approaches are complementary on a multidisciplinary team, linking pharmacists with patient outcomes is difficult when represented only through a drug-related problem classification systems. To facilitate the evolution of pharmacists as providers in the changing healthcare environment, a pharmacist intervention systems was developed that links the medication-centric pharmacist and systems-centric (non-pharmacist) approaches.

Methods: Our electronic medical record (Epic) contained a standard 12 point pharmacist intervention documentation systems: Type (Contraindication/Drug-Drug Interaction/Duplicate Therapy/Dose Change/PK Recommendation), Subytpe (none specified), Status (open/closed), Significance (Critical, High, Medium, Low), Value (numeric scale), Time Spent, Response (accepted/rejected/not applicable/awaiting provider response/informational), Outcomes (Adverse Drug Event/Avoided ADE/Cost Savings/Not Applicable/Optimized Therapy), Associated Users, Scratch Notes, Linked Orders/Labs, and Documentation Notes. Leadership, clinical, staff, and Information Technology pharmacists conducted a multipronged needs analysis. Hospital pharmacists were surveyed to determine accuracy and efficiency of the 12 point documentation process. Physicians were surveyed to determine how clinically meaningful the data extracted from the 12 point documentation process was to them. The coding department was asked to comment on utility of the medication-centric versus systems or diagnosis-centric systems in regards to consistency with ICD-9/10 billing. Administrators were surveyed to identify which systems was most consistent with quality and reimbursement metrics.

Results: Hospital pharmacist feedback revealed: 1) the standard process was too open ended, cumbersome, and subsequently underused, and 2) concern with categorizing interventions under just a systems or diagnosis-centric approach may represent a movement away from the core medication-centric value of pharmacist practice. Physician feedback indicated a lack of understanding of how drug-related problem interventions directly impacted their practice, and that a systems-based (e.g. Cardiovascular) or diagnosis-based (e.g. Heart Failure Exacerbation) structure would improve this. Administrators and coders expressed interest in a systems-based

approach as per systems-based national quality metrics (e.g. 30 day readmissions for Congestive Heart Failure). A systems linking both medication-centric and systems-centric approaches was therefore ideal. Intervention types were redesigned to capture the most clinically meaningful drug-related problem interventions: Pharmacokinetics/Pharmacodynamics, Dose Adjustment/Recommendations, Therapeutics, Adverse Reaction/Allergy, Other. Intervention subtypes were redesigned to concurrently link medication-centric intervention types to a systems-centric classification structure (eg. Cardiovascular, Gastrointestinal, Infectious Disease, etc). The remaining 9 points of the original 12 point intervention documentation systems were eliminated. Interventions increased 27.3% with the new documentation systems. The most common intervention type was Dose Adjustment/Recommendation (40 %). The most common Subtype was Renal (33.6 %) followed by Infectious Disease (13.3 %).

Conclusion: The new intervention classification systems facilitated usual assessment of pharmacist clinical content and efficiency via the medication-centric structure while gaining the ability to reallocate pharmacists to practice settings of greater need per the systems-centric structure. The systems-centric categories proved analogous to the documentation structure of physicians, thereby conferring an automatic understanding of where pharmacists are affecting patient care as it pertains directly to physician practice. Systems-centric intervention distributions enable administrators to align pharmacist involvement in patient care with reimbursement patterns associated with key quality indicators in health care reform.

4-076

Category: General Clinical Practice

Title: Applying Intensive Pharmacotherapeutics to Traditional Medication Reconciliation to Reduce Readmissions

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Purpose: Unique to this medication reconciliation (MR) program is the sequential delivery of pharmacist clinical services through gold standard medication review followed by a patient-specific evidence-based intensive pharmacotherapeutics (IP) clinical evaluation for both acute and chronic problems. This IP-MR assessment and recommendation follows the patient through the entire care continuum through written documentation and verbal handoff to providers. The purposes of this IP-MR program were to expand the pharmacists direct patient care role via IP-MR and to irrefutably link that role to meaningful patient outcomes that establish a clear fiscal necessity of sustaining pharmacists in that practice setting.

Methods: A multidisciplinary team consisting of pharmacists, administrators, nurses, physicians, a quality resources director and a statistician was formed by the Department of Pharmacy to guide the creation and implementation of the IP-MR Program. Medical complexity criteria were established to reflect those co-morbidities and patient populations with the highest risk of drug-related problems and readmission. Pharmacists focus their limited time for home medication review and IP evaluation only on patients meeting these high risk criteria. Pertinent medication review findings and all IP recommendations are documented in a formal IP note in the electronic health record (EHR) and are also sent to targeted providers (e.g. the patients hospitalist, primary care provider, urologist, cardiologist, etc.), usually accompanied with provider verbal communication as well. Errors found on home medication review were classified on an institutionally developed severity scale. Data collected over the first 9 weeks of this service was compared to a randomly selected matched set of patients with similar characteristics. Statistical analysis was carried out by the Bassett Research Institute Statistics and Computing Department. Data shared with leadership resulted in further expansion in scope of the IP- MR program with development of medication reconciliation technicians and a network-wide mandatory nurse education program.

Results: Comparison between the IP-MR patients and the matched set revealed no difference in distribution of gender or high risk criteria co-morbidities, with the IP-MR patients slightly younger than the randomly matched set (mean age 71.3 and 77, respectively) and the IP-MR patients taking slightly more medications than the randomly matched set (mean number of medications 13.5 and 9, respectively). Our program reveals statistically significant reductions

($p < 0.05$) in all of the following outcomes: mean number of home medication list errors, number of patients with 0-30 day all cause readmissions (32.4% absolute reduction), number of patients with 31-60 day all cause readmissions (20.1% absolute reduction), number of patients with 61-90 day all cause readmissions (15.6% absolute reduction), total number cumulative 90 day readmissions, total number of patients with readmission in 90 days (52.6% absolute reduction), and proportion of patients requiring hospital admission for treatment rather than stabilization in ED with discharge home (24.2% absolute reduction.)

Conclusion: Pharmacists practicing clinically in a direct patient care role in the IP-MR program have a dramatic impact in improving patient safety and reducing hospital readmissions. Pharmacist leadership in this program created the unique opportunity to measure and directly links the impact of pharmacist care to reimbursable patient outcomes. Both this clinical practice model and direct link to patient outcomes are critical components to carving out the role of pharmacists in direct patient care as quality over quantity of care increasingly takes precedence in the overall scope of healthcare reform.

4-077

Category: General Clinical Practice

Title: Addressing steroid induced hyperglycemia at a community hospital

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Purpose: Steroid induced hyperglycemia is a well known adverse effect of corticosteroid treatment, and it can occur in both diabetic as well as non-diabetic patients. Hyperglycemia in hospitalized patients has been associated with poor outcomes, and in-hospital mortality rates may be even higher for patients with newly diagnosed hyperglycemia than for those with overt diabetes. Recently updated guidelines recommend point-of-care (POC) glucose monitoring for all patients with known diabetes and in non-diabetic patients receiving corticosteroids. The purpose of this initiative was to create a process to indentify and address steroid induced hyperglycemia in adult patients admitted to a community hospital.

Methods: An adult steroid order set was developed for all adult patients started on steroid therapy. The order set prompted automatic orders for POC glucose monitoring 15 minutes before each meal and at bedtime (or every 6 hours if the patient is NPO or on continuous enteral feedings) for 48 hours. Order instructions included to discontinue monitoring if POC test levels remain less than 180 mg/dL for the first 48 hours but if levels remained over 180 mg/dL twice within 48 hours, call the prescriber for further orders to treat the hyperglycemia. Since this required observation of the previous POC readings by the nurse and identification of hyperglycemia, education was rolled out to nursing staff in the form of a mandatory electronic course as well as interdisciplinary unit-based in-services. Prescribers also completed an in-service and pharmacists were instructed not to enter an initial steroid order if it was not ordered on the steroid order set. Automatic POC glucose monitoring orders were also added to the hospital COPD order set in an effort to capture all initial steroid orders for hospitalized patients. Data was tracked on a monthly basis to determine the percentage of patients ordered steroids who received POC glucose testing.

Results: Prior to the introduction of the order set, only 17% of all hospitalized adult patients who received steroid therapy had POC blood glucose monitoring performed. Over the course of several months monitoring increased as education was rolled out to nursing, pharmacy and prescribers and utilization of the order set increased. Within 10 months, over 80% of hospitalized adult patients prescribed a steroid medication were being monitored for steroid induced hyperglycemia.

Conclusion: Creation of a steroid order set with automatic orders for POC glucose monitoring and parameters for addressing hyperglycemia increased the number of patients who were monitored for steroid induced hyperglycemia. Educating all disciplines on the purpose and importance of POC glucose monitoring led to widespread monitoring and addressing of steroid induced hyperglycemia in hospitalized patients.

4-078

Category: General Clinical Practice

Title: A retrospective evaluation of the predictors of fasting hypoglycemia secondary to basal insulin use

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Purpose: Hyperglycemia has been shown conclusively to lead to worse outcomes for hospitalized patients. One way to improve glycemic control is to discontinue home oral antidiabetic agents and start patients on insulin regimens containing basal insulin. Inherent to the use of basal insulin is an increased risk of hypoglycemia, especially fasting hypoglycemia. Risk factors for hypoglycemia are well-established and include inappropriate insulin dosing, changes in diet and/or activity level and the influence of comorbid medical conditions and medications. The purpose of this study was to evaluate the ability of past blood glucose values to predict future episodes of fasting hypoglycemia.

Methods: This retrospective chart review was approved by the hospitals Institutional Review Board. Patients were included in the study if they had a known diagnosis of diabetes, received at least one dose of basal insulin (insulin glargine or insulin detemir), had at least 24 hours of blood glucose data available and developed fasting hypoglycemia, which was defined as blood glucose less than 70 mg/dL between the hours of 0300 and 0700. Patients were excluded from the study if they were admitted to the intensive care or obstetrics units. A control group of similar patients who received basal insulin but did not develop hypoglycemia was established to make comparisons between groups. Data was collected on baseline demographics, all prior day blood glucose values (including fasting and bedtime) and total units of insulin.

Results: Ninety five patients in the study group were compared with 50 controls. The groups were well matched at baseline. Several factors were shown to significantly increase the risk of hypoglycemia. The factor with the highest risk for next-day fasting hypoglycemia was a bedtime glucose less than 100 mg/dL (OR=15.1, 95 percent confidence interval (CI) 1.73-133.3, p=0.01). A fasting glucose value of 70-99 mg/dL was also shown to predict next-day fasting hypoglycemia (OR=5.0, 95 percent CI 1.82-13.84, p=0.002). Finally, any previous day blood glucose less than 100 mg/dL was also a predictor (OR=4.7, 95 percent CI 2.22-9.77, p less than 0.001). Not surprisingly, units of insulin was also a predictor, with total daily doses greater than 25 units shown to be a risk factor (OR=5.7, 95 percent CI 1.78-18.03, p=0.006).

Conclusion: Several risk factors for fasting hypoglycemia related to previous day glucose values and basal insulin dose were identified. Given the strength of the association with previous day fasting, bedtime and daytime blood glucose values and risk of hypoglycemia, clinicians can use this data to help prevent hypoglycemic events. As hypoglycemic events are associated with poor

patient outcomes and increased length of stay, interventions utilizing data from this study should immediately be put into place.

4-079

Category: General Clinical Practice

Title: Can risk factors for readmission also be used to determine patients at risk for admission medication reconciliation errors?

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Purpose: Two current issues in health-system pharmacy are medication reconciliation (MR) and prevention of readmission. Both can involve pharmacy teams to facilitate interventions and there is often desire to target these services to patients who will benefit most. Previous studies have separately evaluated risk factors for admission MR errors and risk factors for readmission. The objective of this study is to review characteristics of patients with admission MR errors at our facility and assess if there is any overlap with common risk factors for readmission, with a goal of creating a combined evaluation tool for both MR error and readmission risk.

Methods: A retrospective cohort study was performed at a regional acute care medical center using data from 100 randomly selected patients admitted between January 15, 2015 and April 30, 2015. Medication history and reconciliation was performed by either a pharmacist or fourth year pharmacy student using a detailed process. Data collection included accuracy of admission MR, patient barriers to accurate medication history, number of scheduled medications, LACE index, number of admissions within 12 months, if current 30 day readmission, and select comorbid conditions. These factors were compared using Chi-squared test for categorical variables and t-test for independent variables.

Results: Patients with an inaccurate admission MR were 2.5 times more likely to have a barrier to accurate medication history (60% vs 24%, $p<0.05$), with the majority of these barriers being a lack of knowledge of the medications they take at home (52% vs 20% $p<0.05$). Thirty-three percent of all patients had more than ten home medications; the average number of medications for patients with inaccurate admission MR was 10.4, and the average for those with accurate MR was 4.7 ($p<0.05$). The average LACE scores for patients with inaccurate and accurate admission MR was 8 and 6.5, respectively ($p= 0.065$), which trended towards significance. Similarly, the four comorbid conditions assessed (chronic obstructive pulmonary disease, diabetes mellitus, heart failure, and hypertension) were present at greater percentages in the inaccurate MR group (25.3 vs 16, 34.7 vs 20, 20 vs 12, 64 vs 40, percentages respectively). However, none were statistically significant, with only hypertension approaching significance ($p= 0.60$). The number of admissions during the twelve months prior to admission (0.97 vs 0.36) was not significantly different, and the number of current 30-day readmissions could not be accurately assessed due to low numbers.

Conclusion: Patients with higher numbers of medications and lack of knowledge of their home medications were more likely to have an inaccurate admission MR. Programs that increase patient medication knowledge may be an effective way to improve MR accuracy. None of the markers more commonly associated with readmission risk (LACE index, comorbid conditions, number of admissions within twelve months, current 30 day readmission) were statistically higher in patients with inaccurate MR. However, given that some of the markers approached significance, further investigation incorporating these markers into a comprehensive evaluation tool may be warranted.

4-080

Category: Geriatrics

Title: Utility of iPad minis in an IPE community event

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Purpose: To train interprofessional education (IPE) teams to collaborate and deliver clinical and health-education to older adults using a package of selected applications for iPad minis. To create a visual representation of university clinics using the iPad.

Methods: A university IPE team collaborated to provide a wellness and diabetes educational outreach program. The IPE team included nursing, physical therapy, dental hygiene, pharmacy, and physician assistant faculty and students. Monthly planning meetings set objectives and learning strategies for outreach program. Three iPad minis were approved for IPE based outreach and university IRB approval was in place four months prior to event. A training session allowed faculty-student discussion on interdisciplinary roles and training on specific iPad applications and utility. Students were surveyed before the training session and after the outreach program. The IPE team met at a congregate housing for older adults for student-led outreach and education on diabetes and healthcare provider roles. Medication reviews, and blood pressure, diabetic foot and oral screenings were provided. iPad minis were used for medical apps and for dental health clinic visuals.

Results: Surveys of students (n=24) prior to the training session, depicted 50 % of participants did not have any health/medical apps downloaded on their electronic devices; 33% of participants regularly used health/medical apps at their clinic sites. The most frequently used apps by students as noted during the pre-training surveys were Lexicomp, Micromedex, Instant EKG, and Dutton Flashcards. During the training session each profession shared and explained specific iPad applications and this was found to be beneficial. Student confidence in using a health/medical app outside of their profession increased from 14% (pre-training) to 36% (post-outreach program). During the outreach event, 25% of students utilized the iPad mini and at least one of the specific iPad applications. Patients had difficulty utilizing the dental health clinic visuals.

Conclusion: Collaboration and training on medical apps broaden student insight and allow students to conduct an educational outreach program. Logistics and device sharing during the

event suggests all participants should have a device for education. Screen size limits iPad mini utility for some patients when displaying visual data.

4-081

Category: Geriatrics

Title: Incidence of Symptomatic Intracerebral Hemorrhage (sICH) Post-Alteplase in Acute Ischemic Stroke and Validation of the HAT Risk Scale for sICH in a Geriatric Facility

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Purpose: Despite almost 20 years of experience with alteplase for acute ischemic stroke, there is still paucity in data on its utilization in the elderly population, particularly those who are older than 80 years old. The purpose of the retrospective, observational study is to determine the incidence of symptomatic intracerebral hemorrhage (sICH) among patients 80 years of age and older compared to those who are less than 80 (primary outcome) and to validate the Hemorrhage After Thrombolysis (HAT) scoring tool, which predicts the risk of developing sICH, by comparing the scores between the two age groups (secondary outcome).

Methods: This is a retrospective cohort study on patients who have received alteplase for acute ischemic stroke between January 1, 2010 and September 30, 2013 at Banner Boswell Medical Center. The SITS-MOST trial definition of siCH was used, which was any local or remote parenchymal hemorrhage, seen as a dense hematoma greater than 30% of the infarcted area with substance space-occupying effect or as any hemorrhagic lesion outside the infarcted area, within 36 hours from the end of tPA infusion in combination with worsening of neurological function, defined as an increase in NIH Stroke Scale (NIHSS) score of ≥ 4 points from baseline or from the lowest NIHSS value between baseline and at 24 hours, or leading to death from the ICH. The Hemorrhage After Thombolysis (HAT) risk scoring system stratifies the risk of developing sICH by providing scores for history of diabetes or baseline blood glucose > 200 mg/dL, pre-treatment NIHSS score, and presence of easily visible hypodensity on initial head CT scan. The student t ad Fisher exact tests will be used. The c-statistic (area under the receiver operating characteristic curve) and 95% confidence interval used by the HAT trial will be calculated for predictive ability.

Results: There were 79 patients who received tPA for acute ischemic stroke from Jan 1, 2011 to Sept 30, 2013 with a mean age of 76.1 years old (range 46-97). There were 44 patients in the less than 80 years old group compared to 35 in the 80 years old and older group. The incidence of ICH in the less than 80 years old group was 22.7% (10/44) compared to 28.6% (10/35) in the equal to or greater than 80 years old group. There were no significant differences between the two groups with respect to incidence of ICH. The secondary outcome showed that the area under the receiver operating curve (ROC) was 88.6% for all age groups for all types of ICH. The area under the ROC (C-statistic) for all types of ICH for those equal to or greater than 80 years old was 91.2% compared to 84.7% in the other age group, showing that the HAT risk scoring tool had higher predictive ability at 91.2% to determine risk of ICH when using the variables

aforementioned in the older age group. Also, the HAT tool had 90% sensitivity and 80% specificity in predicting ICH in the older age group as well.

Conclusion: There was no significant difference in the incidence of ICH in both age groups. When predicting the risk of developing ICH, the HAT scoring tool may be useful in patients who are 80 years of age or older for clinicians to utilize as a discussion point with the patient and family members. However, as previously noted in the HAT trial, this tool itself should not be used to exclude patients from receiving alteplase. In addition, it is important to note that this tool needs to be validated in a larger scale to determine its utility in all age groups.

4-082

Category: I.V. Therapy / Infusion Devices

Title: Errors in intravenous drug preparation between ready to administer prefilled syringes, ready-to-use syringes and traditional vial and syringe preparation: a randomized cross-over medication preparation study

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Purpose: The correct preparation of IV push medication is of critical importance in the delivery of safe patient care. However, increased workloads, higher patient volumes and staff shortages have put greater demands on nurses. Hence, the safe delivery of IV push medication may be comprised. In order to optimize patient safety, prefilled syringe products such as BD Simplist (BDS) and Carpuject (CJ) are now available. A randomized cross-over simulation study was conducted to compare total time for drug preparation and preparation errors between BDS, CJ and traditional vial and syringe preparation (TVSP).

Methods: Three fully stocked medication rooms to simulate nursing practice in the hospital were created. A total of 24 critical care nurses were randomized into one of the three groups and asked to prepare an IV dose of diphenhydramine 25 mg/mL, ketorolac 30 mg/mL and morphine 2 mg/mL (in random order) using BDS, CJ or TVSP. The total time for the correct preparation of each drug, which included drawing up the medication, labeling and disposal of waste, was measured. Errors in preparation were also observed and documented. Participants were then randomized into the alternative groups until all three drug delivery methods were completed (total of 9 medications were prepared by each nurse; 72 per group). At the completion of the study, nurses were asked to create a rank order of their most to least preferred method of IV drug preparation. Total time for drug preparation between groups was compared using multivariate mixed models, with an adjustment for drug and clustering on study participant. General estimating equations for repeated measures were used to compare error rates between groups.

Results: Both BDS and CJ were associated with significant reductions in mean preparation times compared to TVSP (28.7 sec vs. 28.3 sec vs. 65.8 sec; $p < 0.001$). However, medication preparation errors were significantly reduced with BDS compared to both CJ and TVSP (1.4% vs. 44.4% vs. 66.7%; $P < 0.001$). BDS was also ranked by nurses as the most preferred method, followed by TSVP and CJ.

Conclusion: Despite the fact that BDS was an unfamiliar technology (only 1 of 24 nurses had product experience), BDS was associated with a reduced time for drug preparation, the fewest preparation errors and was most preferred by nurses.

4-083

Category: I.V. Therapy / Infusion Devices

Title: Compatibility of tedizolid phosphate with selected intravenous drugs via simulated Y-site conditions

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Purpose: Tedizolid phosphate (Sivextro), an oxazolidinone antibiotic, available as both an oral and intravenous formulation is FDA approved for the treatment of adults with acute bacterial skin and skin structure infections caused by susceptible Gram-positive organisms. The aim of the current study was to test the physical compatibility of commonly utilized agents that could be co-administered in the clinical setting (15 of which are antimicrobials) with tedizolid phosphate during Y-site administration.

Methods: Tedizolid phosphate vials were reconstituted according to the manufacturers recommendations and further diluted with 0.9% sodium chloride solution to a final concentration of 0.8 mg/mL. All other drugs were prepared according to manufacturers recommendations and diluted with 0.9% sodium chloride (where applicable unless tested undiluted) to highest standard concentrations used clinically. We tested only 0.9% sodium chloride because it is the sole diluent recommended for tedizolid phosphate administration. Room temperature Y-site conditions were simulated in culture tubes by mixing 5mL of tedizolid phosphate solution with 5mL of tested drug solutions. Solutions were switched in the order of drug mixing and all combinations were conducted in duplicate. Solutions were inspected visually against white and black background for clarity, color and Tyndall beam test. Turbidity was measured using a laboratory grade turbidimeter and pH changes were assessed for a 120-minute observation period with checks immediately post-admixture and then at 15, 60, and 120 minutes after mixing. Incompatibility was defined as gross precipitation, positive Tyndall beam test, color changes, and/or increases in turbidity.

Results: Based on change of 0.5 nephlometric turbidity units (NTU), tedizolid phosphate was compatible with 35 drugs; amiodarone, amikacin, ampicillin/sulbactam, azithromycin, aztreonam, bumetanide, cefazolin, cefepime, ceftazidime, ceftriaxone, cefuroxime, colistimethate, cyclosporine, dexamethasone sodium phosphate, dexmedetomidine, dopamine, doripenem, epinephrine, ertapenem, fentanyl, furosemide, heparin, hydrocortisone sodium succinate, hydromorphone, imipenem/cilastatin, levofloxacin, lidocaine, lorazepam, meperidine, methylprednisolone, metoclopramide, midazolam, milrinone and morphine. Of note, diphenhydramine showed increase in turbidity only at 120-minute check time point. Tedizolid phosphate was found to be incompatible with calcium chloride, calcium gluconate, dobutamine, doxycycline, esmolol and magnesium sulphate. There was only 1 case of substantial (>1 unit) changes in pH in the studied drugs (epinephrine at 120-minute check time point).

Conclusion: Of the 41 intravenous drugs evaluated, tedizolid phosphate at the clinically utilized concentration of 0.8 mg/mL was found to be compatible with most of the study drugs. All tested antibiotics were compatible except doxycycline. These data serve to facilitate the administration of tedizolid phosphate to patients receiving other intravenous medications in the acute care setting and lessen the need for a dedicated intravenous line.

4-084

Category: I.V. Therapy / Infusion Devices

Title: Safety implications of the dose change alert function in smart infusion pumps on the administration of high-alert medications

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Purpose: .Most intravenous medication errors occur during administration. Smart pumps can reduce the incidence of dose or rate errors using soft and hard limits. But industry standard dose error reduction software misses errors that occur during titration. The dose change alert was developed to detect errors during titration. The purpose of this study was to evaluate the safety implications of the dose change alert in the Spectrum Infusion System on the administration of high alert medications.

Methods: .This observational analysis included all titratable high-alert drug infusions administered between May 1st and October 31st 2014 (inclusive). Analysis of continuous quality improvement reports included drug library compliance, dose change alerts, soft limit confirmations and cancellations, and hard limit pull back reports for each high-alert drug and care area. The primary outcome was the percentage of dose change alert confirmations and cancellations during the titration of high-alert medications, within the soft limits. The secondary outcomes were the percentage drug library compliance, percentage soft limit confirmations and cancellations, and the percentage of hard limit pull backs.

Results: .Compliance with using the drug library was 96.8%. The percentage of dose change alert confirmations and cancellations, within the soft limits were 48.1% and 1.9%, respectively. The titration of vasopressors resulted in the highest percentage (75%) of dose change alert confirmations. The titration of anticoagulants resulted in the highest percentage (12%) of dose change alert cancellations. The percentage of soft limit confirmation and cancellations were 20.8% and 2.3%, respectively, and the percentage of hard limit pull backs was 3.5%. Titration within the soft limits accounted for 65% of the alerts.

Conclusion: .This study provided insight into the safety implications of the dose change alert on the titration of high-alert medications. Key press errors during titration of high-alert medications can cause patient harm, even within the soft limits. Pharmacists can customize the percentage dose change limit for individual drugs within each care area to provide an additional safety check during titration.

4-085

Category: Infectious Diseases

Title: Colistimethate sodium induced nephrotoxicity,A three years retrospective analysis in Hamad General Hospital,Doha-Qatar

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Purpose: Colistin was discovered in 1949 and was used in most parts of the world. However, the (IV) formulations of colistin and were gradually abandoned in most parts of the world by the early 1980s because of the reported high incidence of nephrotoxicity . Colistimethate sodium was introduced in Hamad General Hospital in 2006 and since that time infectious disease team has been using it, no previous studies were done in HGH regarding the extent of nephrotoxicity caused by colistin. The purpose of this study to evaluate the rate and degree of colisitn induced nephrotoxicity and its association with other factors.

Methods: This was a descriptive retrospective study including all patients older than 18 years of old received Intravenous Colistimethate sodium from 1st January 2012 to 31st December 2014. The degree of nephrotoxicity was calculated based on Risk-Injury-Failure-Loss-End Stage Kidney Disease (RIFLE) criteria. Data were collected using approved data collection sheet. Categorical And Continuous Values Will Be Expressed As Frequency (Percentage) And Mean Sd. Descriptive Statistics Will Be Used To Summarize All Demographic And Other Characteristics Of The Participants. Quantitative Variables Means Between The Groups Will Be Compared Using The Appropriate Statistical Tests. Associations Between Two Or More Qualitative Or Categorical Variables Will Be Assessed Using Chi-Square Test. For Small Cell Frequencies, Chi-Square Test With Continuity Correction Factor Will Be Used. A Two-Sided P Value Of .05 Will Considered To Be Statistically Significant. All Statistical Analyses Will Be Done Using Statistical Packages Spss 21.0.

Results: 300 patients were included initially 40 patients were excluded because they are already on dialysis and 5 patients were excluded as pediatric patients. Among 255 patients, 57 % (146) were male and (43%) were female .mean age was 55 years old among all patients. 8.6 % (22) developed renal risk, 7.4 % (19) patients developed renal injury, and 2.7% (7) developed renal failure according to RIFLE criteria. Overall nephrotoxicity was around 18.7 % in different degrees of renal toxicity, no significant association between dose, gender or age and the degree of nephrotoxicity.

Conclusion: In terms of studies utilizing a standardized definition in the RIFLE criteria. At dosing strategies of six million units daily used during period of analysis, Colistimethate sodium found not to be with high degree of nephrotoxicity as previous researchers thought before.

4-086

Category: Infectious Diseases

Title: Relationship between procalcitonin collection, days of therapy and length of stay for pneumonia and sepsis in a large health system.

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Purpose: Procalcitonin or PCT is an inflammatory marker produced under circumstances of bacterial infections in parts of the body. Levels are not elevated in pure viral infections, thus acting as a potential guide for initiation, and or discontinuation of antibiotics. Procalcitonin serial monitoring protocols have been shown to reduce antibiotic treatment duration and exposure in respiratory tract infections and sepsis. A retrospective analysis of procalcitonin collection in pneumonia and sepsis on days of therapy per 1000 patient days and length of stay was conducted to assess the potential impact of procalcitonin on these two variables in a large health system.

Methods: The use of procalcitonin as a tool in decision making has been best validated in lower respiratory tract infections and sepsis. To help guide the interpretation of procalcitonin levels and its serial monitoring, an algorithm was developed by the Infectious Disease Clinical Advancement Team in a large health system, Providence Health and Services, located in the western United States with 34 acute care facilities. The final algorithm was evidence based and consensus-driven, and embedded in antimicrobial scoring report in EPIC, to aid clinical decisions in early 2014. As of January 2014, procalcitonin was available in all system hospitals, except 7 critical access hospitals, and 7 community hospitals; 20/34, 60 percent. 6 more hospitals instituted procalcitonin testing during the 2014 calendar year, totaling 76 percent of hospitals. Days of therapy per 1000 patient days and length of stay was collected for 15 target antibiotics for pneumonia and sepsis, excluding severe sepsis and septic shock, and stratified by the procalcitonin level. Procalcitonin collection was also determined for facilities with at least one procalcitonin level and greater or equal to one DOT of the same target antibiotics. The data collection time period was the calendar year 2014.

Results: In the procalcitonin algorithm, the decision tree was defined as: less than or equal to 0.1 ng per mL, antibiotics strongly discouraged, less than 0.25 ng per mL, antibiotics discouraged, and greater or equal to 0.25 ng per mL, antibiotics encouraged. There was a statistically significant reduction in length of stay, and days of therapy per 1000 patient days, in both pneumonia and sepsis, if the procalcitonin was less than or equal to 0.1 ng per mL vs. procalcitonin greater than 0.1 ng per mL, p value, less than 0.05. To determine the possible effect of procalcitonin collection on length of stay, and days of therapy per 1000 patient days, the encounters were stratified as follows: for encounters with greater or equal to one day of therapy for the target antibiotics and at least 1 procalcitonin level drawn: category 1 had 0 percent procalcitonin values collected, category 2 had 1 to less than 25 percent, category 3 had 25 to 40

percent, and category 4, greater or equal to 40 percent procalcitonin values collected. Category 4 encounters, compared to category 1, demonstrated statistically significant reduction in both length of stay and days of therapy per 1000 patient days.

Conclusion: There was a statistically significant reduction in both antibiotic utilization and patient length of stay for both disease states and a similar reduction between facilities who collected procalcitonin in greater 40 percent of patient encounters with sepsis or pneumonia vs those who did not. It appears that facilities that collect procalcitonin routinely use that value in decision making, possibly because of a confidence in its ability to aid in decision making based on the level. This is an opportunity for further education on procalcitonin use and the algorithm to realize the same reductions in those facilities with lower collection rates.

4-087

Category: Infectious Diseases

Title: Evaluation and optimization of an established community hospital antimicrobial stewardship program

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Purpose: Antimicrobial stewardship programs (ASPs) are becoming increasingly common across the country. The recent signing of an executive order by President Obama has put even more focus on the need for ASPs. ASPs that are well established may want to perform a gap analysis to reevaluate how their antimicrobial stewardship (AMS) services measure up to the literature. A gap analysis will help determine which direction to take the ASP and what may be needed to help compliment the program. An analysis of a Massachusetts community hospital ASP was conducted to determine a phased approach for enhancing AMS practices.

Methods: A survey was developed to assess gaps in current antimicrobial stewardship (AMS) practices. The analysis compared the current ASP to what a best practice ASP should resemble. The survey was administered to the lead AMS pharmacist, the lead Infectious Disease (ID) physician, and several staff pharmacists. Survey results were compared to see the differences in perception around the current state of the ASP. Next, a deeper dive between the ASP members was conducted to identify gaps in best practices and overall barriers to success. Educational opportunities were identified that included needed education around de-escalation and streamlining of therapy. Finally, the use of the pharmacy electronic surveillance software was analyzed for optimization opportunities. Additional clinical surveillance alerts (or rules) were developed for additional areas of focus for the ASP. A phased approach for deployment of these alerts and other AMS clinical initiatives was also developed.

Results: The results of the survey revealed differences in opinions related to the current state of the ASP. A major theme throughout the responses was a need for more education related to de-escalation as well as evidence based practice supportive material used in making recommendations to medical staff. Education in the form of live continuing education was provided to the pharmacist as well as targeted medical staff. The educational topic of focus was identifying appropriate de-escalation opportunities by the pharmacists. In addition to providing staff education, more clinical reference material was also provided to the pharmacists. The suggested action section within the clinical surveillance software was utilized to provide the pharmacist with easy to reference material when making AMS related recommendations to the medical staff. In addition, more alerts related to easier detection of de-escalation opportunities were also added to the electronic surveillance software. Due to a renewed focus on ASP practices and identifying opportunities for improvement, the ASP demonstrated an increase in documented AMS related clinical activities by 20%.

Conclusion: A well-established ASP still requires periodic analysis to determine clinical areas that could be optimized to increase the success of the program. Taking the time to complete the program gap analysis allowed the ASP to identify areas of improvement and prioritize which activity to embark upon first.

4-088

Category: Infectious Diseases

Title: Development & administration of a cross-sectional survey by a pharmacist research network to assess implementation of pneumococcal immunization recommendations for adults across practice settings

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Purpose: Clinical practice recommendations by the Advisory Committee on Immunization Practices (ACIP) for the prevention of pneumococcal disease in adults provide an opportunity to improve the quality of patient care. Implementation of recommendations requires a multi-disciplinary approach to overcome operational barriers. A scientific process to evaluate the implementation of adult pneumococcal immunization programs within the health-system is needed. Pharmacists are in a unique position to impact multiple levels of care. The objectives of this investigation were to describe the development of a cross-sectional survey and assess its application utilizing a network of pharmacist investigators to evaluate pneumococcal guideline implementation in adults.

Methods: A dual approach was undertaken to develop a data collection instrument and to administer it with pharmacists serving as local investigators. First, a collaborative group of experts in data collection instrument design, immunization practices and clinical care of patients at risk for pneumococcal disease was established. Surveys for inpatient and outpatient practice sites were developed to evaluate for a practice gap between the 2012 ACIP pneumococcal immunization recommendations and actual clinical practice in adults. Both surveys were validated as part of a pilot study conducted at multiple institutions. Second, a research partnership was established with the American College of Clinical Pharmacy Practice-Based Research Network (ACCP PBRN). ACCP PBRN pharmacists in adult clinical practice sites were issued a feasibility assessment. Pharmacists completing the assessment and meeting pre-study inclusion criteria were invited to serve as both: 1) site investigators by collecting institution-level data relating to local pneumococcal immunization protocols, and 2) study subjects by providing opinions about barriers to implementing national pneumococcal immunization guidelines in their respective clinical practice settings. The study protocol was submitted to a central institutional review board (IRB) for review.

Results: Two central IRB approved cross-sectional surveys were developed to assess health-system pneumococcal immunization protocols in both the inpatient and outpatient setting; and to compare pneumococcal immunization program differences between groups or practice sites.

Branching logic along with specific criteria were incorporated into both surveys to assess operational, resource, support and attitudinal barriers from the pharmacists perspective as they relate to current clinical practice recommendations for the prevention of pneumococcal disease in adults. A central IRB provided expedited approval of the study along with guidance that the clinical pharmacist site investigators were not engaged in human subjects research. The feasibility questionnaire identified 139 members of the ACCP PBRN were eligible to serve as investigators, 67 of whom received local IRB approval or a determination that local IRB review was not necessary. Pharmacist investigators from inpatient, outpatient, or both setting types completed a total of 94 surveys to evaluate local adult pneumococcal immunization practices at their respective practice sites.

Conclusion: We were able to develop a cross-sectional survey and establish a partnership with a network of pharmacist investigators to obtain data on adult pneumococcal immunization programs from diverse practice sites in the United States. Pharmacists are well positioned to serve as investigators to evaluate local clinical practice guidelines. This project allows an opportunity to better understand the multiple barriers to implementation of clinical recommendations and bridge the vaccine practice gap.

4-089

Category: Infectious Diseases

Title: Recognition and management of severe malarial infection during the 2014 West African Ebola outbreak

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Case Report: The 2014 West African outbreak of Ebola precipitated international interest in the medical management of Ebola virus disease (EVD) and in imported exotic infections. However, with the spotlight on Ebola, practitioners may have overlooked more common causes of fever and malaise in travelers such as malaria, which remains a major public health issue worldwide. While only 1500-2000 cases are reported annually in the United States, visiting travelers comprise the majority of imported malarial infections domestically. Management of severe malarial infections in the United States involves intravenous quinidine gluconate and either doxycycline, tetracycline, or clindamycin in addition to supportive care. However, respiratory complications may occur despite adequate antimalarial pharmacotherapy. Malaria-associated ARDS (MA-ARDS), a severe complication which may lead to rapid deterioration, has a poor prognosis and high lethality rate. The condition is associated with monocyte and macrophage accumulation in the pulmonary capillaries and alveolar space, thought to reflect phagocytosis of sequestered parasitized erythrocytes in the pulmonary endothelium. Currently, MA-ARDS has few treatment modalities beyond positive pressure ventilation measures and continuation of antimalarial therapy. We review the case of a 53-year old man with concurrent HIV-infection who presented with persistent fever, nausea, diarrhea, and severe thrombocytopenia following a return from Burkina Faso during the autumn of 2014. The patient had a dual plasmodium infection (P. falciparum and P. vivax) with parasitemia of 3.8% as confirmed on a peripheral blood smear. He received a loading dose of 1600 mg (24mg/kg) intravenous quinidine gluconate in the medical-surgical intensive care unit followed by six days of 800 mg (12mg/kg/dose) every eight hours; seven days of intravenous doxycycline 100 mg every 12 hours were also administered. On the third day of therapy, the patient experienced transient dyspnea which responded to diuresis and nebulization of bronchodilators. Continued episodes of dyspnea necessitated transfer back to the intensive care unit and initiation of mechanical ventilation. High dose corticosteroids were initiated on the tenth day of hospitalization following positive-end expiratory pressure (PEEP) management on the ventilator. The patient received methylprednisolone 125 mg IV every six hours for four days with a dose taper and conversion to oral prednisone 20 mg daily. At this point, we learned from the patients family of his HIV-1 positive status, but his home antiretroviral regimen was not initiated. The patient recovered from his condition and left in good health with instructions for a prednisone taper after sixteen days at our institution. Malaria may not be common in the United States, but the growing interconnectedness of global travel has increased the risks for importation of exotic infectious

diseases. With the limelight on EVD, healthcare practitioners must still remain wary of other more commonly encountered imported diseases.

4-090

Category: Infectious Diseases

Title: Impact of a Dashboard to Improve Antimicrobial Stewardship in the Largest Not-For-Profit Healthcare System in the United States

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Purpose: Antimicrobial stewardship plays the most crucial role to control the development of multidrug resistant organisms (MDROs). Given the societal value of antimicrobials and their diminishing effectiveness due to antimicrobial resistance, broad implementation of antimicrobial stewardship programs is critically important. We describe the impact of a dashboard on reduction of antimicrobial pressure at our hospitals located in 23 States compared to the baseline use in 2013 fiscal year (FY).

Methods: A dashboard on the utilization of broad spectrum and niche products was developed to help our facilities to identify areas for improvement to achieve antimicrobial stewardship. Defined daily dose (DDD) per thousand patient days of daptomycin, linezolid, tigecycline, cephalosporins, carbapenems, quinolones, aztreonam are tracked every month and available on the dashboard. System and individual facility average, maximum and minimum DDD/1000 patient days on specific agent/class are available on the intranet.

Results: DDD/1000 patient days for Daptomycin, linezolid, tigecycline, aztreonam, quinolones, cephalosporins, carbapenems were decreased over two years compared to the baseline in 2013. Percentage decrease of DDD/1000 patient days of daptomycin, linezolid, tigecycline, ceftaroline, aztreonam, quinolone, cephalosporins and carbapenems between 2014 and 2015 were 13.6%, 43%, 23.5%, 11.8%, 8.1%, 7.9%, 2% and 2% respectively.

Conclusion: We conclude that a dashboard documenting utilization of board spectrum and niche agents contribute significantly to reduce antimicrobial pressure leading to judicious use and antimicrobial stewardship.

4-091

Category: Infectious Diseases

Title: Impact of Criteria Based Indications on Reduction of Gram Positive Agent Use at a Large Multi-State Health System

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Purpose: Inappropriate antimicrobial use leads to resistance leaving limited options to treat patients. It is critical to promote stewardship by establishing clinical indications for use and monitoring compliance. We describe the impact of criteria based indications of daptomycin, linezolid, tigecycline and ceftaroline utilization in our 80 hospitals located in 22 States and District of Columbia.

Methods: An expert group comprised of physicians and clinical pharmacists from different facilities developed evidence based clinical utilization criteria of the four Gram-positive active agents. This was supported and approved by other system clinical committees. The indications were implemented in the beginning of fiscal year (FY) 2015. Hospital pharmacy leaderships were accountable for engaging with the physicians for implementation of the initiative. In addition, monthly updates on system and individual facility mean, maximum and minimum defined daily dose (DDD)/1000 patient days of each agent were provided to pharmacy leadership. This information was also reviewed at the monthly pharmacy leadership calls.

Results: The use of daptomycin, linezolid and tigecycline (DDD/1000 patient days) decreased by 14%, 43% and 24% compared to baseline in FY 2014. Interestingly, vancomycin DDD/1000 patient days decreased from 106.2 to 87.2 (17.9% decrease).

Conclusion: System-wide criteria based utilization resulted in significant reduction of targeted drug usage while preserving them for appropriate usage.The success was based on clear identification of criteria for use, ownership at local level, and monthly feedback of utilization to all hospitals involved.

4-092

Category: Infectious Diseases

Title: Assessment of compliance with Center for Disease Control and Prevention Core Elements of Hospital Antibiotic Stewardship Programs

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Purpose: In 2014, the Center for Disease Control and Prevention (CDC) published the Core Elements of Hospital Antibiotic Stewardship Programs (ASPs). This document outlined seven necessary elements for hospital ASPs including; leadership support, accountability, multidisciplinary expertise, actionable objectives, tracking and reporting of program activity and stewardship education.

Methods: In order to assess compliance with the CDCs recommendations we conducted an on-line survey of antimicrobial stewardship activity within a 15-hospital network. The survey contained 111 questions based on the seven core elements of ASPs outlined by the CDC, the 2007 Infectious Diseases Society of America (IDSA)/Society for Healthcare Epidemiology of America (SHEA) antimicrobial stewardship guidelines, and available clinical literature. Participants indicated compliance to each question by responding; yes, partial, no, unknown or not applicable. The elements of multidisciplinary expertise, actionable objectives, tracking and reporting of program activity were further evaluated and broken down into four levels (Level 1=basic or beginner to Level 4=complex or advanced program) based on complexity of activity and financial or personnel resource requirements.

Results: Survey responses were received from all 15 institutions (Average Daily Census 115 patients). Respondents were either clinical pharmacy managers or directors of pharmacy. The survey questions with the highest compliance were based on the core elements of accountability (Yes=64%, Partial=16%) and stewardship education (Yes=56%, Partial 16%), while questions with lowest compliance were those focused on the elements of multidisciplinary expertise (Yes=44%, Partial=19%) and leadership commitment (Yes=32%, Partial=14%). With respect to accountability, 80% of the hospitals surveyed reported having a pharmacist champion, while only 47% reported having a physician champion. When surveyed about education for pharmacists, 73% of respondents reported that the pharmacy staff had received formal antimicrobial stewardship training. With respect to leadership commitment, only 20% of the institutions indicated that they received budgeted financial support for ASPs and 40% reported that the facility had a formal written statement of support. The majority of non-compliance with clinical expertise was associated with lack of information technology resources. With respect to the elements of multidisciplinary expertise, actionable objectives, tracking and reporting of

program activity, compliance with Level 1 elements was highest (Yes=70%), while compliance with the more complex activities, Level 4, was lowest (Yes=27%).

Conclusion: The CDC Core Elements of Hospital Antimicrobial Stewardship Programs document provides a basic framework for program development. Clinicians tasked with developing hospital ASPs should evaluate current program activity based on these recommendations and should tailor program activities based on compliance with these elements as well as hospital and patient specific needs.

4-093

Category: Infectious Diseases

Title: Efficacy and Safety of Switching to Simpler Single Tablet Regimen of Elvitegravir/Cobicistat/Emtricitabine/Tenofovir Alafenamide (E/C/F/TAF) in HIV1/Hepatitis B Coinfected Adults in North America and Japan (NCT02071082):

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Purpose: A single tablet with coformulated elvitegravir, cobicistat, emtricitabine, and tenofovir alafenamide (E/C/F/TAF) has demonstrated high efficacy and improved renal and bone safety in Phase 3 trials; TAF has excellent antiHBV activity in a Phase 1b study. This Phase 3b open label study is the first to evaluate the efficacy and safety of switching to single tablet E/C/F/TAF in HIV/HBV coinfected patients.

Methods: Virologically suppressed adults (HIV1 RNA < 50c/mL for more than 6 mos) with chronic HBV infection, no cirrhosis, and eGFR > 50 mL/min switched to E/C/F/TAF. Week (W) 24 viral suppression rates for HIV (HIV1 RNA < 50 c/mL FDA snapshot algorithm) and HBV (HBV DNA < 29 IU/mL Missing=Failure Analysis), biochemical (ALT normalization), serological (HBsAg/HBeAg loss and seroconversion), and safety endpoints are reported.

Results: Participants were older (median age 51), predominantly male (92%), 70% white, 18% black, and 10% Asian. Prior to enrollment, most [69/72 (96%)] patients were on a TDFcontaining regimen and the majority were on a regimen containing ≥2 pills. At baseline, 71/72 (99%) had HIV1 RNA < 50c/mL and 62/72 (86%) had HBV DNA < 29 IU/mL. At W24, 68/72 (94%) had HIV1 RNA < 50c/mL, 62/72 (86%) had HBV DNA < 29 IU/mL, and 67/72 (93%) had normal ALT, including 5 of 10 with baseline abnormal ALT. No patients met prespecified ALT flare criteria (confirmed serum ALT > 2 Day 1 value and >10 ULN); the patient who lost HBsAg and gained HBsAb had a grade 3 ALT abnormality. One of 71 HBsAgpositive patients had HBsAg loss with seroconversion; another individual (1/30 HBeAgpositive patients) experienced HBeAg loss with seroconversion. There was no change in eGFR (1.2, p=0.38). Renal tubular proteinuria decreased with switch to E/C/F/TAF: urine median RBP/Cr ratio decreased from 98.8 g/g to 91.0 g/g (p=.001); urine median beta2microglubulin/Cr ratio decreased from 138.8 g/g to 92.0 g/g (p< .001). Most AEs were mild/moderate; one patient had an AE (increased weight/appetite) leading to study discontinuation. Three treatmentemergent SAEs (acute

Conclusion: Through W24, simplifying to single tablet E/C/F/TAF effectively maintained HIV and HBV virologic suppression while improving liver and renal safety endpoints. E/C/F/TAF shows promise for treating HIV/HBV coinfection.

4-094

Category: Infectious Diseases

Title: Elvitegravir (EVG) /Cobicistat (COBI) /Emtricitabine (FTC)/Tenofovir Disoproxil Fumarate (TDF) is Superior to Ritonavir (RTV) Boosted Atazanavir (ATV) plus FTC/TDF in treatment naive women with HIV-1

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Purpose: Women are under-represented in HIV antiretroviral therapy (ART) studies. The Women AntiretroViral Efficacy and Safety study (WAVES) is the first all-women, international, randomized, double-blind, phase 3 trial designed to evaluate the safety and efficacy of EVG/COBI/FTC/TDF versus ATV+RTV+FTC/TDF.

Methods: HIV-1 infected, ART naive women were randomized (1:1), in a double-blind, global study (North America, Europe, Africa, Asia). Entry criteria included HIV RNA>500 copies(c)/mL and estimated GFR ≥ 70 mL/min. Women who become pregnant had the option to continue on study drug. The primary efficacy endpoint was the proportion of women achieving a HIV-1 RNA< 50 c/mL at Week 48. Safety was assessed throughout the study.

Results: 575 women were enrolled (EVG/COBI/FTC/TDF, n=289 vs ATV+RTV+FTC/TDF, n= 286). Demographic and baseline characteristics were balanced and reflect the global nature of the study. The median age was 35 years and 78% had asymptomatic HIV infection. EVG/COBI/FTC/TDF was statistically superior to ATV+RTV+FTC/TDF, with 87.2% and 80.8%, respectively, achieving HIV-1 RNA <50 c/mL at week 48 (adjusted difference 6.5%, 95% CI 0.4% to 12.6%). Mean increases in CD4 cell counts were similar. No subject experienced virologic failure with resistance in the EVG/COBI/FTC/TDF arm, compared to 3 (1%) in the ATV+RTV+FTC/TDF arm (M184V/I). Both regimens were generally well tolerated, with most adverse events being mild (grade 1) in severity. Mean decreases in eGFR were small and similar at week 48 (-4.5 vs -2.3 mL/min, p=0.15) with no discontinuations due to renal adverse events (AEs) in the EVG/COBI/FTC/TDF arm. Changes in BMD at week 48 were similar at spine (-3.09 vs -3.26, p=0.69) and hip (-3.02 vs -2.55 ,p=0.37). Of the 24 pregnancies reported, 13 women elected to continue study drugs.

Conclusion: EVG/COBIIFTC/TDF was superior to ATV+RTV+FTC/TDF at 48 week, and demonstrated its safety and efficacy for the treatment HIV-1 infection in women. Recruitment, enrollment and retention of women in large multinational trials is feasible.EVG/COBIIFTC/TDF was superior to ATV+RTV+FTC/TDF at 48 week, and demonstrated its safety and efficacy for

the treatment HIV-1 infection in women. Recruitment, enrollment and retention of women in large multinational trials is feasible.

4-095

Category: Infectious Diseases

Title: Analysis of methods of active learning implemented in infectious disease curricula

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Purpose: The role of the student pharmacist has transitioned from the dependent to the independent learner. The 2016 Accreditation Council for Pharmacy Education standards require curricula to place a greater emphasis on active learning (AL). Therefore, it is important for colleges of pharmacy to share innovative ways of teaching to prepare student pharmacists to provide patient-centered care. This descriptive study examined infectious disease (ID) curricula to see what role AL plays.

Methods: A survey was sent via email in March 2015 to representatives of 126 colleges of pharmacy, excluding additional campuses and colleges from Puerto Rico. The representatives included deans, department chairs, and professors that coordinated ID. The email explained the purpose of the study and linked to an anonymous 14-item institutional review board approved Qualtrics survey. Questions were formatted using multiple choice and/or text entry. Initial questions asked about demographic information such as whether the college was public or private or what year the college was founded. Other information gather ranged from the way ID is incorporated into the curriculum to electives offered to the way AL is incorporated into lecture hours. The emphasis was to assess the incorporation of AL into curricula. Two follow-up emails were sent reminding people to complete the survey. The survey was closed on May 2, 2015.

Results: Sixty colleges responded to the survey. 54.4 percent of the schools were private compared to 45.6 percent for public schools. 47.3 percent of colleges had separate courses for ID while the remaining colleges taught ID as part of a therapeutic module. On average 29.8 percent of lecture hours were devoted to AL versus standard note taking. 39.7 percent of courses required textbooks instead of recommending them (60.3 percent). The most common types of AL were case studies (95 percent), required readings prior to class (86.7 percent), and student response systems (53.3 percent). Colleges on average incorporated 4.2 different methods of AL into courses. The most common ways case studies were incorporated into courses alongside standard note taking were integrating the cases into lectures (70 percent), reviewing cases in recitations or workshops (21.7 percent), and requiring student presentations/team based learning (18.3 percent).

Conclusion: AL is an essential component for preparing lifelong learners for rotations, residencies, and careers. In addition to case studies, faculty members are finding new ways to engage student pharmacists with innovative AL exercises. Student pharmacists will be required

to become independent learners, and these methods will prepare them to be providers of patient-centered care.

4-096

Category: Infectious Diseases

Title: Implementation and outcomes of fecal microbiota transplantation in a four hospital system

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Purpose: Incidence of Clostridium difficile infection (CDI) in the U.S. in 2011 was 453,000. Despite antimicrobial treatment, recurrence rates of CDI is 20%, with 45% having a second recurrence. The Gastroenterology Guidelines recommend FMT for third occurrence after failure of pulsed vancomycin therapy. The average cure rate using FMT for CDI is greater than 90%. We evaluated use of FMT in a four hospital system for use in recurrent CDI.

Methods: Retrospective review of 24 charts with collection period from December 2011 through May 2015. Data collection included demographics, date of each positive CDI, antibiotic use 3 months prior to first episode, length of stay, 30 day mortality, donor stool type, and method of administration.

Results: Mean age for FMT was 71 years old with 54% female. Most common method of FMT administration: colonoscopy (71%), endoscopy (17%), nasogastric tube (12%). Most common donor type: related donor (63%) followed by OpenBiome (37%), commercialized stool bank product. Nineteen (79%) were on multiple antibiotics prior to FMT, including cephalosporin (29%), fluoroquinolone (26%), penicillin (15%), macrolide (9%), monobactam (3%), and tetracycline (3%). Five (21%) of the 24 relapsed; two had repeat FMT, one which received two repeat FMTs. One of the five CDI relapse had antibiotic use prior to relapse; unclear cause in other four.

Conclusion: Effective FMT defined as no recurrence of CDI, or if recurrence, causal event was antibiotic use. Effective FMT seen in 20(83%) of the patients. A 22% recurrence rate of CDI post FMT; one patient with multiple recurrences. Majority of patients (79%) received antibiotics within 3 months prior to CDI. No mortality 30 days post FMT (3 excluded because no data 30 days post-transplant). FMT shows promise in preventing recurrent CDI infections and prospective analysis of efficacy, safety, cost, and timing would be valuable to CDI prevention in the future.

4-097

Category: Infectious Diseases

Title: Evaluating use of MALDI-TOF for blood culture isolate identification in a four hospital system

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Purpose: Matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) is utilized to analyze blood, respiratory, wound, and urine samples. MALDI-TOF provides organism identification, followed by Verigene Gram-Positive Blood Culture Test (BC-GP) to identify resistance markers for Staphylococcus aureus and Enterococcus spp, with shortened time to identification. Average time to identification and susceptibility is 48-72 hours for Phoenix, 2.5 hours for identification and resistance markers using Verigene BC-GP, and 30 minutes with MALDI-TOF. Processing one sample using Verigene BC-GP is $70, whereas MALDI-TOF is $5.50. We validated MALDI-TOF against Phoenix using blood samples and determined if MALDI-TOF effectively impacts patient care and cost-effectiveness.

Methods: Retrospective, descriptive, observational study analyzing 113 blood samples collected from October 2014 through April 2015. Positive blood samples identified by traditional culture method Phoenix, then analyzed using MALDI-TOF within 48 hours of confirmed positive gram-positive (GP), gram-negative (GN), anaerobe or yeast organism. Reference used to analyze samples is integrated into the BioTyper software version 3.1.0.4 and compared to a research use only database. Each isolate given a spectral score, evaluated using software, and confirmed correct identification if score value > 2.0 at species level or > 1.7 but < 2.0 at genus level.

Results: Total of 113 (48GP, 40GN, 14 anaerobe, and 11 yeast) analyzed using MALDI-TOF. Thirty-six (90%) GN, twenty-nine (60%) GP , nine (64%) anaerobe, and three (27%) yeast organisms were correctly identified using MALDI-TOF. Time to identification per organism using MALDI-TOF was 30 minutes.

Conclusion: Achieved 90% concordance with GN, 60% with GP, 64% with anaerobes, and 27% with yeast organisms. Annual cost savings using MALDI-TOF for initial gram-positive identification is approximately $57,000 and dramatically shortens time to identification. This has a direct positive impact on patient care.

4-098

Category: Infectious Diseases

Title: Impact of antimicrobial stewardship on the incidence and management of asymptomatic bacteriuria (ASB) and catheter-associated asymptomatic bacteriuria (CA-ASB)

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Purpose: Inappropriate treatment of ASB is one of the leading causes of unnecessary antimicrobial exposure. This contributes to increased rates of antimicrobial resistance, hospital length of stay, cost, and puts patients at risk for unnecessary adverse events. The primary goal of this study is to evaluate the impact of interventions made by an Antimicrobial Stewardship Team (AST) on reducing the incidence of inappropriate antimicrobial therapy in patients with ASB and CA-ASB.

Methods: Institutional review board approval was obtained prior to data collection. This is a single-center, retrospective chart review conducted in adult patients admitted in April 2015 and compared to patients in March 2015 who had a positive urine culture (greater than or equal to 100,000 CFU/ml) with concomitant antimicrobial therapy ordered. Patients were excluded if they were less than 18 years of age, undergoing a urologic procedure with anticipated mucosal bleeding, pregnant, neutropenic (ANC less than 1,500 mm3), receiving treatment for concomitant sources of infection, or if they had significant baseline dementia that prevented reliable assessment of symptoms. This study encompassed three interventions made by the AST. The interventions include (1) addition of more strict criteria to the reflex of urine cultures, (2) education to medical staff, and (3) implementation of an automatic electronic urine culture and antibiotic follow-up task that was prospectively reviewed by the AST pharmacists. The primary outcome is to determine the percentage of patients with inappropriate antimicrobial therapy for ASB/CA-ASB. Secondary outcomes include number and types of pharmacist interventions, duration of antimicrobial therapy, length of hospital stay, incidence of Clostridium difficile infections within 30 days of antimicrobial initiation, and total number of urine cultures performed.

Results: A total of 100 patients were included in the analysis with 50 patients in each group. Baseline characteristics were similar in both groups. The patients in this study were primarily elderly females. The total number of urine cultures per 1000 patient days was 41% lower in the post group (154 versus 91 urine cultures/1000 patient days). There was no significant difference in the rate of inappropriate empiric treatment of ASB (50% vs. 38%, p=0.227), however there was a significant difference in the number of patients who received inappropriate definitive treatment (50% vs. 24%, p = 0.007). There were 41 follow-up tasks completed by pharmacy, 24

(59%) required pharmacy intervention, with 21 out of 23 (91%) interventions being performed and accepted by the physician. There were no statistically significant results observed in the other secondary outcomes which included total duration of antibiotic therapy, length of hospital stay, or incidence of C. difficile infections.

Conclusion: The implementation of a multimodal antimicrobial stewardship led initiative did not significantly reduce the percent of patients with ASB and CA-ASB who were initiated on therapy however it significantly decreased the number of patients maintained on antibiotic treatment, as well as the total number of urine cultures performed in the hospital.

4-099

Category: Infectious Diseases

Title: Impact of an antimicrobial stewardship at an 82 bed long-term acute care hospital

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Purpose: The initial purpose of this project, in June 2012, was to document the impact of an Antimicrobial Stewardship Program (ASP) in an 82-bed LTACH and its effect on healthcare costs over a one-year period (Year 1). The ASP has been continued for three successive years. This is the report of the third year of documenting the effectiveness of the ASP.

Methods: During years 2 and 3, the ASP was comprised of a committee that included one infectious disease (ID) physician, all intensivists at the hospital, all pharmacists and one infection control preventionist. Year 1 had two ID physicians and no intensivists. A standard antimicrobial order form that was developed in year 1 and continued antimicrobial use policies which required physicians to de-escalate empiric therapy within 72 hours as implemented in the first year study were continued through year three. The policy also restricted the use of the following antimicrobials and required an infectious disease consult within 48 hours: aminoglycosides, ceftaroline, colistimethate, daptomycin, fidaxomicin, linezolid and tigecycline. However during year 2, intensivists were allowed to continue all antimicrobials due to limited working hours of ID physician. The committee communicated and monitored for appropriate dosing, lab values (serum creatinine), cost effective drugs, culture and sensitivity report, interval and de-escalation recommendations, and peak and trough levels. Patient days, medication cost, average length of stay, and the case mix index data were compared before and after implementing the ASP. The data was continuously collected and analyzed annually until April 30, 2015 to compare with baseline.

Results: During the baseline year, June 2011 to May 2012 (before the ASP), the patient days (PDs) were 22,228 with an average length of stay (ALOS) of 27.71 days. PDs and ALOS during the same period in year 1 and year 2 were 21,304 and 27.27 days and 14,633 and 26.97 days, respectively. During year 3 (June 2014 to April 2015), PDs were 12,058 and ALOS 25.78 days. The year 3 ALOS decreased by 4.4 percent from baseline. During the same period, the case mix index (CMI) increased from 1.29 at baseline to 1.36 at year 3, an increase of 6.6 percent. Overall, drug cost per patient-day for year 3 was $63.41, a decreased of 19 percent from $78.14 at baseline. Antibiotic cost per patient-day for year 3 was $32.93, a decrease of 19 percent from $40.60 at baseline. Antifungal cost per patient-day of $2.20 for year 3, was a decrease of 8

percent from $2.38 at baseline. Antiviral cost per patient-day of $2.76 for year 2, a decreased of 32 percent from $4.07 at baseline.

Conclusion: ASP implementation at an 82-bed LTACH showed a reduction in the ALOS from baseline to years 1, 2 and 3, even with a CMI increase of 6.6 percent over the same three year period. Regardless of higher severity of patient conditions as indicated by the increase in CMI, the ALOS and medication cost for antimicrobials, antifungals, and antivirals decreased for each of the three years of the ASP. Considering the cost of the antimicrobials, antifungals, and antivirals monitored, when adjusted for inflation, the cost savings for the past 35 months are estimated as $561,382 after ASP.

4-100

Category: Infectious Diseases

Title: Restriction of ertapenem to outpatient use yields cost savings and decreases carbapenem utilization

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Purpose: Carbapenem antibiotics are commonly utilized in the treatment of resistant infections. Our institution stocks imipenem, meropenem and ertapenem . Recently the availability of generic versions of imipenem and meropenem has yielded savings. Ertapenem remains costly .Ertapenem has similar efficacy in treatment of resistant organisms with the exception of pseudomonas. Ertapenem has the advantage of a once daily infusion. Our institution implemented a recommendation to restrict ertapenem to outpatient infusions with inpatient infusions restricted to imipenem or meropenem.It was hoped this restriction would yield cost savings for the inpatient units and retain the once daily

Methods: Our Organization changed recommendations for use of carbapenems in September of 2014. Our organization restricted ertapenem to the outpatient infusion with meropenem or imipenem being utilized for inpatients

Results: Beginning in October 2014 all ertapenem orders were restricted to the outpatient infusion center. Ertapenem was approved for one test dose to assess tolerability prior to discharge with orders for outpatient infusion of ertapenem. All other inpatient orders for carbapenem were restricted to either: meropenem of imipenem. In the six month period prior to the change in recommendations for carbapenem use the defined daily dose (DDD) carbapenems were 185 doses of carbapenems per 1,000 acute patient days, in the 6 month period following the restriction of ertapenem the DDD per 1,000 acute patient days declined to 67 doses for a 64% decrease in overall carbapenem utilization. In the 6 month period prior to the restriction of ertapenem the cost for purchases of carbapenems were $1.21 per acute patient day, in the following six month period the cost dropped to $0.61 per acute patient day a 50% cost savings

Conclusion: Restriction of ertapenem to outpatient infusion yielded both a reduction in carbapenem utilization of 64% and a decrease in costs at our institution by 50%

4-101

Category: Investigational Drugs

Title: Patiromer lowered serum potassium for up to 1 year in hyperkalemic patients with diabetes and advanced kidney disease on RAAS inhibitors

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Purpose: Diabetes is a risk factor for chronic kidney disease (CKD), and CKD and diabetes co-occurrence increases risk of poor outcomes. Guidelines recommend renin-angiotensin-aldosterone inhibitors (RAASi) to slow diabetic kidney disease (DKD) progression; however, DKD elevates hyperkalemia risk, which limits RAASi use. Poor tolerability of available potassium-binding agents for hyperkalemia treatment may limit use. The AMETHYST-DN study evaluated patiromer, a novel, nonabsorbed potassium-binder, in a 1-year trial of patients with DKD on RAASi. This post hoc subanalysis reports results of long-term patiromer therapy in patients with advanced CKD (stages 4-5).

Methods: AMETHYST-DN was a multicenter, open-label trial of 306 patients with estimated glomerular filtration rate (eGFR) 15 to less than 60 mL/min/1.73 square meters, type 2 diabetes, hypertension and documented hyperkalemia (serum potassium greater than 5.0 mEq/L) on RAASi. Patients were randomized to patiromer starting doses by baseline serum potassium greater than 5.0 to 5.5 mEq/L (mild hyperkalemia), 4.2, 8.4, or 12.6 g twice daily (BID); and greater than 5.5 to less than 6.0 mEq/L (moderate hyperkalemia), 8.4, 12.6, or 16.8 g BID. Patiromer was titrated, if needed, to achieve and maintain serum potassium of less than or equal to 5.0 mEq/L. A total of 74 patients had CKD stage 4 to 5; 41 patients presented with mild hyperkalemia and 33 with moderate hyperkalemia. Mean changes in serum potassium from baseline were analyzed at prespecified intervals during treatment and posttreatment follow-up.

Results: Advanced CKD patients had diagnosed diabetes (mean, 14 years) and median urine albumin-to-creatinine ratio of 632 mg/g at baseline. Patiromer induced significant (P-value less than 0.01) reductions in mean serum potassium in these patients at the first postbaseline assessment, 48 hours after the first dose, from baseline means of 5.2 mEq/L (mild hyperkalemia) and 5.7 mEq/L (moderate hyperkalemia). Similar effects were observed across starting dose groups. In advanced CKD patients mean serum potassium was controlled (less than or equal to 5.0 mEq/L) at 48 hours (mild hyperkalemia) and at week 1 (moderate hyperkalemia) and maintained for 52 weeks. Cessation of patiromer treatment led to a rise in mean serum potassium. Of the randomized advanced CKD patients, 56 percent completed the trial (the most common reasons for early withdrawal were consent withdrawal [13.3 percent] and adverse

events [9.3 percent]). Constipation was the most common gastrointestinal adverse event (9.5 percent, none severe; led to discontinuation in 1 [1.4 percent] patient). Six patients (8.1 percent) had serum potassium less than 3.5 mEq/L (none less than 3.0 mEq/L) and 3 (4.1 percent) had serum magnesium less than1.2 mg/dL (none less than 1.0 mg/dL).

Conclusion: Chronic treatment with patiromer in hyperkalemic patients with advanced DKD receiving RAASi was well tolerated and maintained serum potassium less than or equal to 5.0 mEq/L for up to 1 year. Serum potassium monitoring may be required after patiromer discontinuation.

4-102

Category: Investigational Drugs

Title: Patiromer reduced serum potassium in hyperkalemic patients with HF and advanced CKD on RAAS inhibitors: results from OPAL-HK and AMETHYST-DN

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Purpose: Renin-angiotensin-aldosterone inhibitors inhibitors (RAASi) can reduce mortality in patients with heart failure (HF) and chronic kidney disease (CKD), yet hyperkalemia can limit RAASi use in these patients. We evaluated the effect of patiromer, a novel investigational potassium binder, on serum potassium in hyperkalemia patients with HF and advanced CKD on RAASi.

Methods: OPAL-HK was a 12-week, 2-part, randomized, single-blind study; AMETHYST-DN was a 52-week, randomized, open-label study. Eligible patients had estimated glomerular filtration rate (eGFR) 15-59 ml/min; were on at least 1 RAASi; and in AMETHYST-DN, had type 2 diabetes mellitus. Patients with New York Heart Association class 4 HF were excluded. Entry serum potassium was 5.1 to less than 6.5 mEq/L (OPAL-HK) and greater than 5.0 to less than 6.0 mEq/L (AMETHYST-DN). In a post hoc subgroup analysis, efficacy data were pooled over the first 4 weeks in patients with HF and stage 3b to 5 CKD and analyzed for serum potassium change from baseline (primary endpoint) by serum potassium strata: greater than 5.0 to 5.5 (mild) and greater than 5.5 to less than 6.0 mEq/L (moderate/severe) in AMETHYST-DN; 5.1 to less than 5.5 (mild) and 5.5 to less than 6.5 mEq/L (moderate/severe) in OPAL-HK.

Results: Of HF patients with advanced CKD, 66 had mild and 66 had moderate/severe hyperkalemia. Patients were primarily male (approximately 60 percent) and aged 65 years or older (62 percent); mean (standard deviation [SD]) eGFR was 29 (10) in mild and 27 (9) mL/min/1.73 square meters in moderate/severe patients. With patiromer mean serum potassium was reduced to less than 5.0 mEq/L by the first postbaseline visit (day 3) in mild hyperkalemia and by week 1 in moderate/ severe hyperkalemia patients and continued to improve over time. By week 4, mean (95 percent confidence interval [CI]) serum potassium change from baseline was −0.62 mEq/L (−0.74, −0.50) in mild hyperkalemia and −1.13 mEq/L (−1.28, −0.97) in moderate/severe hyperkalemia patients; P was less than 0.001 for both. One patient developed serum potassium levels of less than 3.5 mEq/L through week 4. Adverse events (AEs) were predominately mild-to-moderate gastrointestinal complaints; AEs led to patiromer discontinuation in 6 patients in each study over the entire study period.

Conclusion: Patiromer significantly reduced serum potassium in hyperkalemia patients with HF and advanced CKD over 4 weeks. If approved, patiromer may be an option for hyperkalemia treatment in patients with HF and advanced CKD

4-103

Category: Leadership

Title: Preparing future health care leaders and advocates: elective course design and evaluation.

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Purpose: At a pivotal time for the profession of pharmacy, it is critical that student pharmacists are developed as leaders and advocates for their profession. After evaluating the curriculum and student interest in leadership curriculum, we designed and offered an elective course focused on developing student pharmacists leadership and advocacy skills to help them become more engaged in the profession. Our objectives are to describe the design and evaluation of a Leadership and Advocacy in Health Care elective course.

Methods: The course aimed at developing student abilities to identify political and social elements that can be used to shape future health policy, to critically evaluate current health policy issues, and to describe the advocacy role pharmacists can play at the local, state and national levels. Additionally, the course exposed students to principles of strengths based leadership, Kotters 8-step model for leading change, leadership styles, emotional and cultural intelligence and group dynamics. Flipped classroom instructional strategy was employed with readings derived from books, Harvard Business Review, and primary literature. Students were required to engage in professional advocacy during the course and examine their strength, leadership style, and develop a personal mission statement. Students weekly reflections and short essays, as well as in-class discussion participation were used for course assessment. Course evaluations were used to gather student perceptions regarding the course. A long-term follow-up survey was sent to previous course participants to evaluate whether the knowledge and skills obtained in the course were useful during post-graduate training and practice.

Results: Forty-five P2 or P3 students enrolled into the course over 4 years. Student advocacy efforts differed from year to year and included a presentation at a local high school with the goal to educate minority students about pharmacy as a health career and the role of pharmacists in population and public health, planning and participation in Massachusetts legislative days, and participation in state and national letter writing campaign to advocate for the provider status. Course evaluations revealed that all students agreed this course helped them further develop their leadership skills and 95% of students felt well prepared to communicate with a legislator. Long-term follow-up survey was completed by 67% of course participants. At the time of the survey 45% of respondents were students, 15% were residents, and 30% were practicing pharmacists (with 83% reporting having leadership/ managerial responsibilities). All respondents agreed that the knowledge and skills gained in the course prepared them for clinical rotations, residency or

current job, as well as encouraged further participation in professional organizations. All respondents agreed that they feel more comfortable engaging in advocacy efforts and all but one agreed that they stay aware of currently legislation that will affect the profession of pharmacy.

Conclusion: Regardless of whether someone has a title or position of authority, the need for leadership in health professions and the ability of practitioners to influence change is imperative. With provider status for pharmacists on the horizon, students need to learn about and demonstrate quality patient care and improve health outcomes, while advocating for the profession of pharmacy. Updated American Council for Pharmacy Education Standards 2016 guide the schools to develop leadership competency in all students and further work can include incorporating elements of this elective course into the required PharmD curriculum.

4-104

Category: Leadership

Title: Innovating and collaborating- synergy between the hospital pharmacy and the university

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Purpose: We established a mutually beneficial, cost neutral partnership between a university School of Pharmacy (SoP) and a teaching hospital Pharmacy Department (PD) bringing hospital pharmacy into the undergraduate curriculum. The European statements of hospital pharmacy recommend that undergraduate pharmacy curricula include experience of hospital pharmacy practice.

Methods: The collaboration was underpinned my a memorandum of understanding giving a clear stepwise growth in input by the hospital pharmacy. The following new elements have been added to the students curriculum: 1. Therapeutics lectures from practicing clinical pharmacists, aiding contextualisation of material. 2. Small group workshops at the MMUH provide an opportunity to integrate knowledge and apply it to the management of clinical problems in individual patients 4. Experential learning at the bedside where students review patients under the supervision of an experienced clinical pharmacist 3. Career and management seminars, giving exposure to the reality of decision making in health care. 4. CV preparation and interview skills for structured summer placements offered in the hospitals.

Results: Mutual benefits of Partnership : Positive student feedback has highlighted the knowledge of pharmacy staff, the real life focus of the material and teaching methods. MMUH Pharmacists were appointed honorary lecturers of the RCSI. Expert input from RCSI staff into MMUH practice research. Enhanced profile of the pharmacy department within the hospital and nationally. This cost neutral collaboration has addressed an unmet need in Irish pharmacy undergraduate education and will equip pharmacy students to be the patient centred professionals of the future, ensuring that patients are supported to the fullest extent by educated, competent and empathetic pharmacists while enhancing career development for hospital pharmacists. Fifteen of the department staff are now honorary lecturers of the RCSI. Be

Conclusion: We have renewed the partnership for a further three years. Other universities and hospital pharmacies have also adopted this model which may be a basis upon which to build the new integrated pharmacy course.

4-105

Title: Pharmacist Privileging and Credentialing: The What and How To in a Community Hospital Environment

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Purpose: As the pharmacists' scope of practice has expanded over the years, so has their ability to better impact patient healthcare outcomes. Credentialing and privileging can define what qualifications are necessary to practice pharmacy at an institution and provide a list of specific duties that pharmacists may perform. Privileging and credentialing can encourage greater collaboration among physicians, pharmacists, and other providers. Allowing pharmacists to be privileged and credentialed members of the medical staff can improve patient access to healthcare, particularly in a community hospital setting. Utilizing pharmacists training and expertise as patient care providers since they already reside and practice in

Methods: We have developed a Pharmacist Privileging and Credentialing Task Force that has outlined a WorkPlan defining the processes to be followed to obtain pharmacist privileging and credentialing in a community hospital setting. This Task Force has coordinated and developed educational material, policies, and procedures and implemented this program based on a targeted approach and methodology that can be customized and implemented to successfully drive performance in many different clinical practice settings and is applicable to many.

Results: Privileging and credentialing can provide a medication management focused program in your institution. The healthcare system incurs billions due to improper drug use, drug-related problems. Pharmacists are proven to improve patient outcomes as well as decreasing costs to the healthcare system. To date, we have successfully privileged and credentialed pharmacists at two facilities and the Pharmacist Privileging and Credentialing Task Force is in the process of working the process through eleven more.

Conclusion: The process of privileging and credentialing pharmacists can be a lengthy and intense process. Utilization of a Task Force to network, coordinate and develop materials has quickened the timeline and facilitated knowledge transfer resulting in successful privileging and credentialing at several hospital locations.

4-106

Category: Leadership

Title: Impact of Multi-disciplinary Team Led Medication Management Process in the Largest Not-for-Profit Health System in the United States

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Purpose: With the rapidly changing health care delivery model, it is critical that medication management processes across the continuum of care at each health care facility is integrated to close many gaps that we have in our current delivery model As the largest not for profit health system in the U.S. located in 23 States, we are continuously striving for excellence in medication management processes by exploring the gaps and identifying avenues to implement pharmacist led multi-disciplinary efforts to optimize care outcomes. We describe our experiences with patient care delivery process strategies, triumphs and the future.

Methods: A national multi-disciplinary committee comprised of physicians, pharmacists, nurses and administrators was established in 2013 with the task of establishing evidence based practice of medicine, improved medication usage and outcome. A multidisciplinary clinician expert and operation expert group was formed to augment the goals of the national committee. The objective was to identify and close the gaps in medication safety, outcomes and evidence based practice of medicine in the continuum of care throughout the system. Each quality, safety and therapeutic topic is reviewed critically by content experts. In addition, a partnership was formed with the Institute of Safe Medicine Practices (ISMP) to train multi-disciplinary leaders on medication safety, assess safety gaps and implement ISMP recommended quarterly action safety agenda items.A clinical decision support was implemented in 2015 to optimize efficiency in pharmacist led medication management processes.

Results: Fifty five evidence based therapeutic initiatives with the help of 350 expert clinicians have been implemented resulting in $8 million and $15 million system savings in fiscal year 2013-14 and 2014-15 respectively. Partnership with the ISMP have resulted in closing some of the gaps in safety processes, The clinical decision support system is helping pharmacists to make real time interventions to optimize medication therapy outcomes. Our partnership with the American Society of Health System Pharmacists (ASHP) has resulted in standardized staff competency and sterile compounding training across the system. We have also partnered with the Center for Disease Control and the White House to achieve the goals of the recently declared

National Action Plan to Combat Antimicrobial Resistance. Our antibiotic stewardship program has resulted in reduction of broad spectrum agent use.

Conclusion: Integrating medication management processes in the continuum of care is complex and challenging. Our experience demonstrates the true value of team work between stakeholders and the results are self evident. We have built the foundation. We are confident that we would be able to address other gaps to integrate our care delivery in the near future.

4-107

Category: Nutrition Support

Title: Body weight and serum albumin concentration changes in gastrointestinal cancer patients on parenteral nutrition managed by a nutrition support pharmacist

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Purpose: Weight loss and other symptoms of malnutrition have been well documented in patients with gastrointestinal cancer. In general, weight loss and decreased albumin levels correlate with poor prognosis in cancer patients. The purpose of this study is to evaluate the effects of parenteral nutrition (PN) on body weight and serum albumin concentrations of gastrointestinal cancer patients and to compare the results of the management by the pharmacist of the nutrition support team (NST) to the non-team management.

Methods: A retrospective chart review was conducted on 37 nonsurgical gastrointestinal cancer patients who had received PN for longer than 5 days in our Hospital. Out of the 37 patients, 16 patients had received PN management by the NST pharmacist(NST group, 43.2%) while 21 patients were managed by their attending physicians(non-NST group, 56.8%). The NST pharmacist assessed the nutritional requirements of each patient and provided patient-specific PN formulas. Body weight and serum albumin levels were measured before the start of PN (day 0) and 7 days after (day 7).

Results: Both mean energy and protein delivery were higher in the NST group (22.8kcal/kg per day, SD 6.6 and 1.02g/kg per day, SD 0.20) compared to the non-NST group (19.5kcal/kg per day, SD 5.6 and 0.83g/kg per day, SD 0.31). There were no significant differences in body weight between day 0 and day 7 for both groups; NST group decreased 0.08kg (49.13kg to 49.04kg, p-value of 0.91), non-NST group decreased 0.14kg (51.61kg to 51.47kg, p-value of 0.80). Serum albumin levels decreased significantly in the non-NST group (0.18g/dL, 2.99g/gL to 2.81g/dL, p-value<0.05) but did not change significantly in the NST group (0.11g/dL, 3.18g/gL to 3.07g/dL, p-value of 0.32).

Conclusion: The short term administration of PN may not reverse weight loss and hypoalbuminemia in gastrointestinal cancer patients. However, we did observe there was no further weight loss and decrease of serum albumin levels only in the NST group. Thus, we may conclude that the NST pharmacist's expertise in providing individualized PN may at least help prevent further nutritional deterioration of patients in need of parenteral nutrition.

4-108

Category: Nutrition Support

Title: Redesigned approach to ordering parenteral nutrition in a small community hospital.

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Purpose: Parenteral nutrition (PN) is classified by the Institute for Safe Medication Practices (ISMP) as a high-alert medication due to significant risk of patient harm. As a result, a comprehensive PN medication use evaluation (MUE) was recently conducted at our facility, a small community hospital. Results of the MUE revealed multiple areas for improvement mostly related to the computerized order entry (CPOE) environment. The areas targeted for improvement were PN formula selection and timely ordering of appropriate monitoring labs. The purpose of this study is to describe the redesign of the PN ordering process following the MUE.

Methods: Results of the PN MUE were presented at 4 different administrative and clinical committees over the course of 2 months. The general consensus was that key elements of the PN ordering process needed improvement and the assistance of the clinical dietician and medical informatics team was enlisted. Change requests were formally submitted to allow alteration of the CPOE order screen and to create a PN lab order set which automatically triggers daily orders for appropriate monitoring labs whenever PN is initiated. Additionally, the current clinical policy regarding PN was revised and presented at 2 separate administrative and clinical committees over the course of another month. Staff pharmacists were educated on the revised policy, the new PN lab order set, the modified PN formula list as well as a newly created internal monitoring spreadsheet.

Results: The PN MUE identified that the base formula dextrose 25% with amino acids 4.25% had not been ordered in over a year, so it was deleted from the CPOE screen and formulary, thus streamlining the choices available during the ordering process. Also identified was the need for a standardized PN lab order set as the PN MUE revealed that only 61% of patients had their magnesium level checked at baseline or within 24 hours of PN initiation and only 52% of patients had their phosphorus level checked similarly. No patients had their prealbumin monitored during their admission. Additionally, while 87% of patients initiated lipid emulsions simultaneously with PN, only 13% had their serum triglyceride level monitored for appropriateness and tolerability. The PN lab order set now includes magnesium, phosphorus, and prealbumin daily for the first 4 days of therapy and then biweekly thereafter, in addition to the pre-existing complete metabolic profile (CMP). Also, pharmacists may order a serum triglyceride level per policy/protocol, if not already ordered, in those patients receiving lipid emulsions. The internal use of a newly created PN spreadsheet for each patient has improved the process for monitoring labs chronologically and identifying areas for possible pharmacist intervention.

Conclusion: Reducing risk of patient harm associated with high-alert medications triggered a comprehensive MUE of PN for the year 2014 and identified multiple areas for medication safety

improvement, mostly associated with the CPOE ordering process. Through interdisciplinary collaboration with the clinical dietician and medical informatics team, the CPOE PN ordering screen was streamlined by deleting obsolete products as well as modifying the PN lab order set to include magnesium, phosphorus, and prealbumin. Thorough revision of the current PN policy, which was approved by the hospital's clinical and administrative staff, now allows pharmacists to order appropriate monitoring labs per policy/protocol.

4-109

Category: Oncology

Title: BEAM me up!: establishing stem cell transplantation in a developing nation

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Purpose: As part of a collaborative effort between MGH, the Bangladesh government, Dhaka Medical College and Hospital, and the AKKhan Healthcare Trust, the first BMT program in Bangladesh was established. The purposes of this presentation are to describe the nurse/pharmacist collaboration in relation to educating the DMCH staff to prophylactically manage difficult symptoms of the disease and side effects of treatments and to administer the chemotherapy conditioning regimen BEAM (carmustine, etoposide, cytarabine, and melphalan) and to discuss the culture shift necessary to consider the prophylactic use of medications.

Methods: The initial step was educating the entire team including pharmacists, nurses, and physicians. Topics included: classes of chemotherapy medications, toxicities, side effects, preparation, administration of medications, and management of side effects. We then had to guarantee an adequate supply of the chemotherapy medications needed for this regimen. An initial intervention included the preparation of chemotherapy medication bags that were spiked and primed in a biological cabinet instead of the patients bedsides. Education emphasizing the need for prophylaxis of anti-emesis medications when administering highly emetogenic chemotherapy was implemented and re-enforced throughout the patients stay. Culturally, patients were reluctant to proactively ask for medications unless nausea and vomiting was intolerable. Alternatively physicians didnt want to give anti-emetics prophylactically if patients were not complaining or requesting them. A second obstacle was changing the professional culture from physician-only care management to establishing an interdisciplinary team approach where nursing and pharmacy were valued and integrated team members. This was done by establishing daily rounds which incorporated the entire healthcare team seeing the patient together then holding rounds outside patients rooms. At that time that the overall plan of care, concerns, and goals for the day and questions were answered amongst the interdisciplinary team.

Results: The patient who underwent the first autologous SCT for primary refractory Hodgkin lymphoma with the BEAM conditioning regimen had many challenges. His transplant was complicated by loss of appetite, weight loss, diarrhea, nausea with emesis, mucositis and fever with hypotension requiring vasopressor support for approximately 24 hours. He developed pneumonia with pleural effusions and had dyspnea on exertion. Blood cultures were positive for

Pseudomonas aeruginosa and the central line had to be removed. Count recovery began around day +10, however, the patient remained hospitalized due to bacteremia and pneumonia for another two weeks requiring antibiotic treatment. Education of the patients on expected transplant course, side effects of chemotherapy and encouragement to notify RN or MD of side effects/concerns was also trialed. A recent trip in June 2015 showed that rounds have been successfully implemented on the BMT unit. Pharmacists and nurses appear to be more respected and involved members of the healthcare team as evidenced by strong participation in daily rounds and presentations during seminars for the medical/nursing staff. The prophylactic administration of medications is still not current practice. On evaluation, non-adherence appears to be related to cost of medications; ideally to defray costs versus lack of education.

Conclusion: One of the biggest challenges we faced was changing the culture. Prophylactic anti-emetic administration was not current practice, although the staff had been appropriately educated, this best practice was not maintained. Another obstacle included the implementation of spiking and priming all chemotherapy bags in a biological cabinet instead of at the patients bedside bedpans. We educated that this practice exposes all involved to hazardous chemotherapy agents. This practice change has not been incorporated. The final hurdle was a limited inventory due to costs and availability from India. Despite many challenges, the BEAM regimen was successfully administered to the patient.

4-110

Category: Oncology

Title: Implementation of a multidisciplinary oral chemotherapy clinic in a community based ambulatory cancer center

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Purpose: The accelerating growth of oral chemotherapy use has highlighted challenges regarding safe and effective use of these agents in the ambulatory cancer population. High drug cost, adverse events, drug interactions, and coordination of care difficulties have been identified as barriers to optimal oral chemotherapy utilization. The presence of these factors may lead to suboptimal therapeutic outcomes and adversely affect patient safety. As a result, our institution developed a multidisciplinary oral chemotherapy clinic (OCC) to improve drug utilization, and optimize therapeutic outcomes in our oral chemotherapy patients.

Methods: An oncology pharmacist led an initiative to create a multidisciplinary oral chemotherapy clinic. The referring oncologist, oncology pharmacist, oncology nurse navigator and oncologist nurse partner comprised the team. Any patient started on oral chemotherapy by one of two center oncologists was eligible to be referred to the clinic under a pharmacy collaborative practice agreement. After oral chemotherapy prescribing, basic instruction by the oncologist and transmission of the prescription to the specialty pharmacy by the oncology nurse partner, patients were scheduled for an initial one-hour on-site consultation with the oncology pharmacist and oncology nurse navigator. At the visit, drug acquisition issues and patient financial needs were addressed by the team. Physical assessment, monitoring parameters, safe handling and disposition, in-depth drug teaching, drug interaction screening, and coordination-of-care issues were also addressed. Patient understanding was assessed via verbalization, and appropriate written materials were provided. The visit was subsequently billed through CMS facility fee structure. The patient was followed by telephone by the nurses and the pharmacist at one-week, two-week and monthly intervals thereafter, or whenever the patient initiated contact. Identified issues were assessed by the team and managed by telephone or scheduled physician visit.

Results: The clinic was implemented in December 2014 under a six-month proof-of-concept operation. As of June 15, 2015, 21 patients were seen by the clinic (12 men and nine women, average overall age 73.8 years). Kidney (n = 5) and prostate cancer (n = 3) were most common. The team made 44 interventions in four categories: financial assistance (20%); coordination of care (34%); adverse events (32%); and drug interactions (14%). Nine patients of 21 (43%) required financial assistance including copay assistance (n = 6), free drug (n = 2), and other (n =

1) programs. Fourteen patients (67%) experienced adverse events, with the most common being fatigue (n = 4); diarrhea (n = 3); and dizziness, pruritus, and palmar-plantar erythrodysesthesia (each n = 2). As a result of the teams interventions, oral chemotherapy was held (9%), discontinued (29%), dose reduced (19%), or no change made (43%). Billing procedures were implemented in March 2015, with 86% of eligible patients billed. Documentation of initial patient visits occurred in the electronic medical record (EMR) at 100%, with subsequent patient encounters documented in the EMR (57%) or via paper documentation (43%).

Conclusion: Implementation of a multidisciplinary oral chemotherapy team has made a positive impact on medication utilization and therapeutic outcomes of oral chemotherapy patients by facilitating financial assistance, addressing adverse events and evaluating drug interactions. The multidisciplinary approach allowed different health care professionals to collaborate for the overall benefit of the patient, and indicated that this approach has the utility and potential to provide high-level patient care in this setting.

4-111

Category: Oncology

Title: Ethanol as gemcitabine excipient

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Purpose: Ethanol is used as an excipient that enhances the solubility of gemcitabine. Patients receiving gemcitabine formulated as a concentrate for solution for infusion may be given ethanol at much higher doses than those considered to be toxic (>3 g/dose; 10 g of ethanol are equivalent to 1 glass of wine or beer). The aim of this study was to assess ethanol related symptoms and signs in patients receiving two formulations of gemcitabine.

Methods: We conducted a randomized double blind cross-over study. All patients being treated with gemcitabine received two consecutive doses of the drug, one diluted from a concentrate for solution for infusion containing ethanol and the other from a lyophilized powder. Thus, each treatment course was separated by at least a 7-day wash-out period. Patients were surveyed after each administration in order to asses the appearance of any alcohol consumption symptoms (dizziness, difficulty speaking, unsteady walking, impaired balance, mood swings and slower reactions). Blood alcohol concentration was estimated using Widmark formula and the amount of alcohol measured on the breath (breathalyzer). Gender, weight, age and drinking habits were also recorded in order to evaluate patient alcohol tolerance.

Results: Of 30 randomly assigned patients, 25 met the following prespecified criteria: exposure to both formulations and completion of the questionnaire. Mean administered ethanol dose when prepared from concentrate for solution for infusion was 15.81+/-2.25 g (mean+/-SD). When using concentrate for solution for infusion gemcitabine, estimated blood ethanol concentration was 0.033 mg/dL according to Widmark formula and 0.02 mg/dL according to breathalyzer results. No statistically significant relationship was found in the incidence of overall ethanol related symptoms between both formulations (OR, 1.50; 95% IC, 0.43 to 5.26; p=0.53) or in any individual ethanol related symptom.

Conclusion: There is no difference in the onset of ethanol consumption related symptoms when using concentrate for solution for infusion instead of lyophilized powder on the reconstitution of

gemcitabine. This is the first study, to our knowledge, to evaluate the appearance of symptoms after the administration of high doses of intravenous ethanol.

4-112

Category: Oncology

Title: Effect of modified hydration protocol on hyponatremia and hypokalemia caused by cisplatin-containing chemotherapy

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Purpose: It has been reported that the addition of magnesium, which is renal protective, is recommended for chemotherapy including cisplatin. For cisplatin hydration, sodium chloride 0.9 percent with magnesium is recommended by the National Comprehensive Cancer Network Chemotherapy Order Templates. According to the recommendation, this hydration method has been implemented in our hospital. However, because we have replaced lactated Ringer's solution with normal saline for the hydration, blood levels of electrolytes might be altered. Therefore, we evaluated the effect of this change in hydration on serum electrolyte levels and renal function retrospectively.

Methods: We retrospectively evaluated the patients who received chemotherapy including cisplatin (50 mg/m2 or more) from July 2010 to January 2014 in respiratory medicine. The patients who lacked lab data on days 6 to 10 were excluded. We examined patient characteristics, serum levels of electrolytes, renal function and adverse effects caused by cisplatin in medical records. Our old hydration method which was composed of lactated Ringer's solution with furosemide was compared to a new hydration method composed of normal saline plus magnesium sulfate and mannitol. The incidence of any grade of adverse effects was compared before and after the change of cisplatin hydration. Adverse effects were graded by the National Cancer Institute's Common Terminology Criteria for Adverse Events Version 4.0.

Results: This study included 92 patients (old hydration method: 37 patients, new hydration method: 55 patients) and 235 courses (old hydration method: 101 courses, new hydration method: 135 courses). There were no significant differences in the background of the patients, with exception to performance status and anticancer drugs used with cisplatin. The frequency of hyponatremia (36 percent vs. 22 percent, P less than 0.05) and hypokalemia (23 percent vs. 3 percent, P less than 0.01) of any grade was decreased significantly after the alternation of hydration. In addition, no acute renal failure was observed in the new hydration group, whereas acute renal failure was observed in 12 percent of subjects in the old hydration group.

Conclusion: Decreased incidence of hyponatremia might be caused by the increase of sodium content in the hydration. Although potassium content in the hydration decreased, the incidence of hypokalemia also decreased. The change of diuretic agent, from furosemide to mannitol might be one important factor affecting the serum potassium level. This data suggests that the change of

hydration method for cisplatin from lactated Ringer's solution with furosemide to normal saline including mannitol and magnesium sulfate will decrease the incidence of hyponatremia, hypokalemia and acute renal failure caused by cisplatin. This hydration regimen is recommended in practical use.

4-113

Category: Pain Management

Title: Impact of an opioid toxicity risk assessment tool and pharmacist led opioid sparing protocol on opioid safety in a community hospital

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Purpose: Extensive research has been conducted in order to identify risk factors that lead to severe opioid-related adverse events (ADEs). Expert guidelines recommend screening patients for these risk factors. Guidelines also recommend consistent monitoring of patients on opioids and multimodal pain management. No tool thus far has been established to aid in the screening process. An assessment tool was designed utilizing a point scale system corresponding to the evidence-based risk factors for severe opioid-related ADEs. In this study, the effects of the Novel Opioid Toxicity Risk Assessment (NOTRA) tool along with multimodal pain management on severe opioid ADEs were examined.

Methods: This is an IRB-approved bi-phasic study of patients 18 years on an orthopedic floor with a hydromorphone order. Phase I consisted of a retrospective review of patients in the month of October 2013. NOTRA was used to compare the number of patients who experienced severe opioid adverse events in Group A, 6 points, and Group B, < 6 points. Phase II consisted of a prospective review of patients in January 2015. NOTRA was used to help the pharmacist identify patients in Group A and recommend multimodal pain management. Finally, the number of patients who experienced severe opioid adverse events in Group A from Phase I and from Phase II was compared.

Results: A total of 62 patients in retrospective and 52 patients in prospective phase were included in this study. In Phase one 24/62 patients and in Phase two 23/52 patients were classified as Group A. In the retrospective phase, Group A experienced more falls (4% vs. 0%), ileus (4% vs. 2.6%), oversedation (12.5% vs. 0%), and oversedation requiring naloxone (8.3% vs. 0%) compared to Group B. Furthermore, Group A in the prospective phase experienced 0% falls, 0% oversedation, and 0% oversedation requiring naloxone. In the prospective phase, 39% of patients required intervention and 25% of pharmacist recommendations were accepted. Overall, patients experienced equivalent reduction in pain scores; i.e., 76.5% Phase I Group A vs. 79.2% Phase II Group A.

Conclusion: NOTRA identified patients at highest risk for severe opioid-related ADE and multimodal pain management decreased the number of severe opioid-related ADEs without compromising pain relief in the prospective phase. NOTRA is a promising start for an opioid toxicity risk screening tool.

4-114

Category: Pain Management

Title: Pharmacokinetic considerations of sublingual sufentanil when used for acute pain management in various surgical populations

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Purpose: The sufentanil sublingual tablet system is a non-invasive PCA product currently under review by FDA and EMA for treatment of moderate to severe acute pain in a hospital setting. A second sufentanil product, a 30mcg tablet dispensed using a single-dose applicator, is also in development for treatment of pain in a medically-supervised setting, such as outpatient surgery. Sufentanil appears well-suited for pain management when delivered sublingually as a result of its unique pharmacokinetic properties. It offers rapid equilibration between plasma and CNS (t1/2ke0 = 6min) and a CST1/2 of approximately 2.5 hours, suggesting a more predictable analgesic onset and off-set.

Methods: The objective of this analysis was to examine the Phase 3 efficacy, safety and patient satisfaction results of sublingual sufentanil tablets when used for post-operative pain management in both ambulatory (abdominal) and in-patient (abdominal and major joint replacement) surgical populations. All trials were randomized and placebo-controlled with primary efficacy measures that included the time-weighted sum of pain intensity differences (SPID) to baseline over the 12-hour (outpatient surgery) or 48-hour (in-patient surgery) study periods. Key secondary endpoints included pain intensity and pain relief by study time-point, inter-dosing interval, required rescue medication and patient and nurse satisfaction ratings. Safety assessments consisted of spontaneously reported adverse events (AE), vital signs, concomitant medications and early termination.

Results: The primary efficacy variable, the time-weighted summed pain intensity difference to baseline over the 12 or 48-hour study period was compared for the active and placebo arms in all studies. Statistically significant differences for SPID were observed in favor of sublingual sufentanil for each of the three trials. Secondary endpoint evaluation also suggested patients found sublingual sufentanil treatment to be effective and well-tolerated. Most AEs were mild to moderate in severity and typical of opioid exposure (nausea, vomiting, pruritus).

Conclusion: Sufentanil tablets dispensed sublingually with a handheld PCA device or by a healthcare professional using a single-dose applicator are in development for treatment of

patients with moderate-to-severe acute pain. Results of three, pivotal phase 3 trials suggest that sufentanils non-invasive route of delivery, fast onset of analgesia and patient satisfaction/tolerability suggest it may be a useful alternative to IM or IV dosing.

4-115

Category: Pain Management

Title: Liposomal Bupivacaine versus Conventional Bupivacaine: An Analysis to Determine Hospital Utility to Provide Optimal Patient Care

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Purpose: Liposomal bupivacaine, a local anesthetic used to block the conduction and initiation of nerve impulses, continues to be utilized in total knee replacement procedures despite evidence suggesting it is not clinically more effective at reducing a patient's daily opioid requirement or provide increased postoperative pain control during hospitalization. The purpose of this study is to determine if liposomal bupivacaine compared to conventional bupivacaine reduces overall length of hospital stay to justify its relative cost compared to other available anesthetic agents. The study will also assess pain control and opioid usage in patients undergoing this elective procedure.

Methods: An Institutional Review Board approved retrospective chart review conducted at University Hospitals Health System. All patients included in the study were 18 years of age or older who underwent a total knee replacement procedure. Exclusion criteria included patients who received any dose of liposomal bupivacaine other than the 266mg dose as FDA approved for other surgical procedures, patients who received an alternative anesthetic within 20 minutes of liposomal bupivacaine administration, patients who did not undergo total knee replacement surgery, and pregnancy. The primary endpoint was overall length of hospital stay. Secondary endpoints were cumulative pain score during hospitalization, time to first severe (7-10) pain score post-surgery, percentage of mild (0-3) documented pain scores, percentage of moderate (4-6) documented pain scores, percentage of severe (7-10) documented pain scores, average pain per pain assessment during hospitalization, oral morphine equivalent (OME) received during hospitalization, and average oral morphine equivalent utilized per hospital day. 53 patients were required to achieve a 90% power to detect a 0.5 day difference in overall length of hospital stay between the two groups. Statistical analysis was performed using the students t-test for comparisons of continuous data and the Fishers exact test for comparisons of nominal data.

Results: A total of 152 patient charts were evaluated and 150 patients met inclusion and exclusion criteria, 75 patients per group. Baseline characteristics were similar in both the control conventional bupivacaine and experimental liposomal bupivacaine groups. Overall length of stay in the liposomal bupivacaine group was 3.01 days (2.79-3.24) 95% CI compared to 3.24 days (3.15-3.33) 95% CI in the conventional bupivacaine group (p=0.066). Cumulative pain score during hospitalization in the liposomal bupivacaine group was 60.3 vs 68.0 in the conventional group (p=0.27), time to first severe (7-10) pain score post-surgery was 6.65 hr vs. 6.84 hr (p=0.94), percentage of mild (0-3) documented pain scores was 63.7% vs. 57.8% (p=0.052),

percentage of moderate (4-6) documented pain scores was 28.3% vs. 26.9% (p=0.47), percentage of severe (7-10) documented pain scores was 13.8% vs. 9.3% (p=0.79), oral morphine equivalent (OME) received during hospitalization was 82.87mg vs. 67.83 (p=0.10) and average oral morphine equivalent utilized per hospital day was 27.80mg vs. 21.13mg (p=0.042) in the liposomal bupivacaine group vs. conventional bupivacaine group respectively.

Conclusion: Liposomal bupivacaine utilized in total knee replacement patients resulted in a non-statistically significant shorter average length of hospital stay when compared to conventional bupivacaine. Liposomal bupivacaine did not show a benefit on overall pain control during hospitalization and in fact showed a statistically significant increase in average oral morphine equivalent utilized per hospital day with liposomal bupivacaine patients receiving 27.80mg/day vs. conventional bupivacaine 21.13mg/day (p=0.042). At this time, liposomal bupivacaine does not provide additional benefit to justify its use in patients undergoing elective total knee replacement surgery.

4-116

Category: Pain Management

Title: Approach to improve patient satisfaction on pain management at a large teaching institution

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Purpose: Appropriate pain management is necessary for overall patient satisfaction. The aim of this study was to assess whether counseling patients and setting appropriate expectations around pain management will help improve patient satisfaction as reflected by an increase in the HCAHPS (Hospital Consumer Assessment of Healthcare Providers and Systems) pain domain survey score.

Methods: A prospective study was conducted for 4 weeks on a medical-surgical floor at a large teaching institution in New Jersey. The study received approval by the Institutional Review Board (IRB) committee. Study inclusion criteria consisted of adult, post-surgical patients having pain and receiving pain medications with ability to self-report their condition. Patients were counseled regarding their pain management using a set of standard counseling points. The primary outcome was to compare the HCAHPS pain domain survey score post-counseling to the institutions baseline score. In addition, the proportion of patients requiring intervention, experiencing adverse effects and receiving non-opioid analgesics for pain management were assessed. Patient satisfaction was assessed verbally at the end of the counseling session.

Results: A total of 70 patients were counseled regarding their pain and pain management. Four patients were excluded from analysis of the primary outcome due to inpatient location. The post-counseling HCAHPS survey score for overall pain management at NBIMC increased to 86 percent from a pre-counseling score of 63 percent. The change in percentile rank for overall pain management was 90 among all the databases. Among the NJ peer group database, the change in percentile rank was 92. An opportunity for therapeutic intervention occurred in 40 percent of patients. The interventions included: discontinuing a medication (24 percent), adding a pain scale (17 percent), increasing dose (3 percent), and changing to an alternative medication (10 percent). 80 percent of patients experienced adverse effect(s) from opioids: itchiness (27 percent), drowsiness (26 percent), difficulty breathing (3 percent), and constipation (24 percent). Only 3 (4 percent) patients were receiving a regimen utilizing opioid free pain medications. At the end of the counseling session, 100 percent of the patients said that they wanted this counseling to occur and were satisfied.

Conclusion: Patients require continuous education by pharmacists regarding their pain management to help facilitate appropriate care, understand medications, set realistic expectations for pain relief, and avoid adverse effects. Pharmacist counseling on pain management can make a positive impact on patients perspective of pain and help improve patient satisfaction.

4-117

Category: Pain Management

Title: Analgesic effect of scheduled tramadol in patients with concomitant strong cytochrome 2D6 inhibitors

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Purpose: Tramadol requires metabolism via O-demethylation by Cytochrome 2D6 to an active metabolite. Previous research has shown patients who are poor CYP2D6 metabolizers have decreased metabolism to the active metabolite. Some small pharmacokinetic studies have shown decreased metabolism when combined with a strong CYP2D6 inhibitor and a weak CYP2D6 inhibitor. The objectives of this study are (1) To determine if the use of a strong CYP 2D6 inhibitor with scheduled tramadol increases the need for breakthrough opioid, and (2) To determine if the use of a strong CYP 2D6 inhibitor with scheduled tramadol decreases patients mean pain scores.

Methods: This is an IRB approved retrospective chart review to evaluate hospitalized patients receiving scheduled tramadol with and without a concurrent strong CYP2D6 inhibitor. The strong CYP2D6 inhibitors include paroxetine, bupropion, fluoxetine, and quinidine. Inclusion criteria for participants included those at least 18 years of age, receiving concurrent scheduled tramadol and a strong CYP2D6 inhibitor for at least 24 hours, and pain scores assessed utilizing the 0-10 numerical pain scale during use of scheduled tramadol. Exclusion criteria for participants included patients receiving suboptimal tramadol therapy, and patients receiving scheduled ondansetron without a 24-hour ondansetron-free period. A study population of 37 participants was needed to provide 80% power to find a 10mg OME difference in breakthrough opioid use for patients receiving strong CYP2D6 inhibitors. Secondary endpoints included mean pain score per assessment, length of stay, and discontinuation rate of tramadol. Data analysis for both primary and secondary endpoints utilized a student t-test for any continuous data, log-transformation for any positively skewed data, a chi-squared test for nominal data, and a Fishers exact test when appropriate. A query of electronic health medical record within the University Hospitals Health System from 1/1/2012- 9/30/2014 was utilized.

Results: A total of 80 patients were included with 40 in each group. Concomitant strong CYP2D6 inhibitor with schedule tramadol resulted in significantly more use of breakthrough opioid per day (12.23mg OME (95%CI: 6.75-22.17) vs. 3.75mg OME (95%CI: 2.09-6.71) p=0.005). The overall use of opioid was also higher in the strong CYP2D6 inhibitor group (29.49mg OME (95%CI: 13.42-64.77) vs. 7.37mg OME (95%CI: 3.51-15.50), p=0.01). There was not a significant difference for length of stay (5 days (95% CI: 3.87-6.46) vs. 5.77 days (95%CI: 4.54-7.33), p=0.41), numerical pain score (4.47 (95%CI: 3.88-5.06) vs. 4.46 (95%CI:

3.86-5.10), p=0.99). There was also not a significant difference in tramadol discontinuation between the strong CYP2D6 inhibitor group and placebo (11.25% vs. 8.75%, p=0.58).

Conclusion: The use of concomitant strong CYP2D6 inhibitors with scheduled tramadol lead to significantly more use of breakthrough opioid than the scheduled tramadol without a strong CYP2D6 inhibitor group. The strong CYP2D6 inhibitor group did not show a significant difference in length of stay, mean pain scores, or tramadol discontinuation.

4-118

Category: Pain Management

Title: Appropriate use and dosage of hydromorphone amongst opioid naive patients: medication use evaluation and improvement action plan

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Purpose: The overuse of hydromorphone and other opiates in the inpatient setting has several unintended consequences. The Joint Commission released an alert regarding the safe use of opioids in hospitals. They attribute the causes of adverse events associated with opioids to a lack of understanding of potency differences between medications. Opioid naivety is considered a risk factor for increased adverse reactions. The purpose of this quality improvement project was to address the high dosing of hydromorphone and bring to light the equivalency differences between opioids, specifically hydromorphone and morphine.

Methods: The project was approved by the institutions Medication Safety Committee. Thirty patients receiving high dose hydromorphone (defined as 4mg intravenous greater than twice daily) and low dose hydromorphone (defined as 2mg intravenous less than three times daily) in our institution were used for the review of prior opioid use. Chart review focused on the intravenous doses of hydromorphone, indication for pain medication, and use of any opioids in the previous year. Patients were not included if they had active cancer or were receiving hospice/palliative care. Opioid naivety was defined as the absence of prior opioid use in the previous year. Opioid tolerant patients were defined as having prior use of opioids as an inpatient or outpatient based on chart review and medical reconciliation documents. Three separate reviews were conducted to assess the rate of opioid use in naive patients. An initial review of the use of the 2mg and 4mg dosages was conducted to provide the basis for the project. A follow up review of thirty patients occurred after education and process improvements occurred was performed. The final review of thirty patients was performed a year later to ensure that the changes made were effective to change prescribing and utilization.

Results: The primary review showed the following rates of opioid use in naive patients: 20 percent in the high dose hydromorphone group and 40 percent in the low dose group. The high percentages prompted the team to design our set of corrective actions. An intense education campaign occurred to clarify differences in opioid potency, which we chose morphine as a comparator. Dose equivalency documents between the agents were distributed to the staff which displayed morphine equivalents of the doses of hydromorphone patients had been receiving. Electronic ordering of medications was changed to display default doses of hydromorphone to 0.5mg and 1mg when physicians ordered the medication. Our stock strengths of intravenous hydromorphone were changed in medication dispensing machines from 2mg and 4mg to 0.5mg

and 1mg dosage forms. The first follow up review occurred six months after implementation of previously stated actions which showed zero percent use of high dose and seven percent use of low dose hydromorphone in opioid naive patients. Final review one year after process implementation revealed zero percent use of both high and low dose hydromorphone in opioid naive patients.

Conclusion: Our initial review revealed a large percentage of patients receiving high dose hydromorphone. Based on these results, the team decided to implement the corrective actions discussed previously to limit the high dosing of hydromorphone and address potency awareness of opioids. Measures taken by our team dramatically reduced the amount of hydromorphone usage in opioid naive patients to zero percent. Additionally, the medical staff was thoroughly educated on potency differences and the potential adverse effects of high dose opioids to ensure appropriate future opioid orders.

4-119

Category: Pain Management

Title: Comparison of two pain management approaches in trauma patients: evaluating nursing autonomy with dose ranges versus hospital's standard of care, a pilot study.

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Purpose: As needed pain medication orders have long been used as a strategy in managing different levels of pain in trauma patients and nurses have had a pivotal role. Dose range orders allow for individualized regimens , but there are potential safety concerns. Regulatory bodies (e.g. The Joint Commission) allow for range order use as long as policies and procedures are in place to ensure standardization of care. This study evaluates the extension of nursing autonomy using an innovative, multi-modal, analgesic pre-formatted order set with dose ranges compared to historical control (hospitals standard of care or HC.)

Methods: Open-label, prospective, comparative pilot study. Trauma patients were included if they were 18 years of age or older, admitted for longer than 24 hours, had a Glasgow coma motor score of 6, and were able to communicate verbally or in writing. Patients who were on patient-controlled analgesia, transferred to the ICU, on comfort care or hospice, or received pain medications outside of the new PFO in the intervention arm (INT) were excluded. Twenty patients were required in each group to detect a 2 point difference in the numeric rating scale (NRS) pain score with an 80 percent confidence and alpha of 0.05. Thirty patients in both the HC and INT arms were analyzed. The primary outcome measure was a difference in pain scores between HC and INT arms using the NRS and visual descriptor scale (VDS) pain scale. Secondary outcomes included medication administration for moderate to severe pain, total opioid use, length of stay (LOS), naloxone use, as well as patient and nursing satisfaction. Independent t-tests were utilized for the primary outcomes analysis.

Results: Mean NRS scores for the HC and INT arms were 4.07 and 3.13 (P equals 0.218), and mean VDS counts for none, mild, moderate and severe pain were 2.27, 4.37, 3.77, and 4.47 for the historical group and 0.73, 3.6, 3.47, and 2.57 for the INT arm respectively (P equals 0.086, 0.409, 0.218, and 0.083). NRS pain assessment counts were 122 (HC) and 65 (INT) (P equals 0.042). Medications provided for moderate to severe pain were 86.45% for HC and 86.29% for INT arm (P equals 0.967). Total mean oral morphine equivalents were 76.12 mg and 49.35 mg for the HC and INT arms (P equals 0.087). LOS was 1.2 days shorter for the INT group (P equals 0.107). Naloxone was not administered in either group. Patients in both arms expressed similar satisfaction, while nurses expressed greater satisfaction with pain management in the INT arm. A Poisson and linear regression adjusted for age, being on concurrent scheduled analgesics and LOS showed that the INT arm patients were 39% less likely to report an additional event of

severe pain compared to HC (P equals 0.004). Further, INT arm patients received an average of 30.97 mg less morphine equivalents (P equals 0.047).

Conclusion: Patients in the INT arm were significantly less likely to report an additional VDS severe pain score and used less opioid pain medications compared to the HC group. There was a trend in the INT arm for less opiate use and lower LOS. Nursing satisfaction was also greater in the INT arm. NRS pains scores did not significantly decrease in either arm but NRS assessments documented were significantly lower in the INT arm. The innovative PFO was well-received by the trauma team, safe and able to promote nursing autonomy and critical thinking in the analgesic management of trauma patients.

4-120

Category: Pain Management

Title: Impact of prescriber education and electronic medical record changes on dosing of hydromorphone.

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Purpose: Hydromorphone is listed as a top ten drug to cause patient harm due to its ability to cause profound respiratory depression and a deficiency of knowledge in appropriate equianalgesic dosing. The equianalgesic dose of 2 mg intravenous hydromorphone is 14 mg intravenous morphine. One a previous survey only 27% of prescribers answered true to the statement Dilaudid 1-2 mg is ~ equal to 7-13 mg of IV morphine. The purpose of this was study was to determine if prescriber education and changes in the electronic medical record could decrease the amount of hydromorphone doses greater than 2 mg.

Methods: Baseline data on dosing of hydromorphone was collected from May 2013-October 2013. In January 2014 prescriber education on equianalgesic dosing and safety considerations with hydromorphone was released to the hospitalist, emergency medicine and surgery departments. Also, the following changes were made in the electronic medical record: equianalgesic ordering comments were added, default dosing was changed to 0.5 mg IV every 4 hours as needed for a pain scale 7-10, the button to select a 2 mg dose was removed and a 0.25 mg button was added, and weight based dosing was removed. Follow-up data was collected from April-June 2014. Data collected for both periods included the doses of hydromorphone prescribed and the prescriber who prescribed the dose. Comparison between the groups was performed using Microsoft Excel . For nominal data, a chi-squared test was performed.

Results: Hydromorphone doses below 0.5 mg were 0.3% of the total doses in the baseline data and 92% of total doses in the follow-up period (p-value is less than 0.001). 0.5 mg doses also experienced a statistically significant increase (17.1% vs 32.8% p-value is less than 0.001). 1 mg and 2 mg doses experienced a statistically significant decrease (64.3% vs 52.1%, p-value is less than 0.001 and 18.0% vs 12.0%, p-value is less than 0.001). Of 16 prescribers who were identified as a top 2mg prescriber in the baseline data, 14 had decrease in the percentage of 2 mg doses in the follow-up period. The largest decrease was from 55% of the hydromorphone doses ordered being greater than 2 mg to 28% of hydromorphone doses ordered being greater than 2 mg.

Conclusion: This study concludes that by implementing targeted prescriber education and changes to an EMR system that rates of hydromorphone doses greater than 2 mg can be

decreased, which is likely to improve patient outcomes. Further studies are needed to determine if this decrease in 2 mg doses translates to improved patient outcomes.

4-121

Category: Pediatrics

Title: Retrospective analysis of intravenous and oral acetaminophen use for closure of patent ductus arteriosis in premature neonates

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Purpose: In the last several years, acetaminophen has been proposed as an effective treatment for patent ductus arteriosis (PDA) in premature neonates. Although several case series have been published, efficacy data is lacking, and most studies have used acetaminophen as a second-line medication when first-line ibuprofen or indomethacin has failed. The purpose of this study was to retrospectively analyze the outcome of first-line acetaminophen treatment for closure of patent ductus arteriosis (PDA) in premature neonates at one hospital center neonatal intensive care unit (NICU) over a three year period.

Methods: Due to drug shortages and other site-specific issues, our NICU began treating symptomatic PDA exclusively using acetaminophen in 2012. This retrospective case series included neonates given courses of either oral or intravenous acetaminophen, or both, as first-line treatment for PDA closure. Patients admitted to the NICU and treated with scheduled doses of acetaminophen were identified retrospectively via the electronic healthcare database. De-identified patient data was analyzed for the study, which was approved by the institutional review board (IRB). Decrease in B-naturetic peptide (BNP) levels and a reduction in PDA size on heart echocardiogram after treatment were evaluated as markers of treatment success.

Results: From January 2012 until November 2014, sixteen neonates were treated with acetaminophen for a hemodynamically significant PDA. The most common dose used was 15 mg/kg every 6 hours. After treatment, PDA size was reduced on heart echo in 7 patients (44%), and was unchanged in 8 patients (50%). B-naturetic peptide (BNP) levels were reduced by an average of 51% after treatment (95% CI -88% to -14%). Median treatment course was 16 doses (4 days), although several patients required more than 24 doses (6 days). Patients who started treatment in the first 7 days of life had an average BNP reduction of 84% (95% CI -97% to -71%), vs 27% (95% CI -88% to +34%) in patients treated after 7 days. However, this difference was not statistically significant (p=0.06). There was no difference in BNP reduction in patients treated with intravenous versus oral acetaminophen (p=0.32).

Conclusion: Although recently published case series have shown high rates of PDA closure (70-80%) with acetaminophen treatment, our use of acetaminophen resulted in reduction of PDA size less than 50% of the time, and extended treatment courses were often required. In this group, all patients were treated first line with acetaminophen, in contrast with most other published case series. Previous hypotheses that earlier pharmacological treatment for PDA is more effective

than later treatment were supported in our case series by a trend toward greater BNP reduction if treatment was started in the first 7 days of life.

4-122

Category: Pediatrics

Title: Factors affecting successful mobilization and harvest of hematopoietic progenitor cells by addition of plerixafor to granulocyte colony stimulating factor (GCSF) and subsequent apheresis in pediatrics

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Purpose: The efficacy of plerixafor in peripheral blood stem cell (PBSC) mobilization has been explored in many studies with adult population, but not yet in pediatric population. Here, the efficacy of plerixafor when used with GCSF in hematopoietic stem cell mobilization for autologous transplantation on pediatric patients who were treated with plerixafor at University of Michigan Health System (UMHS) C.S. Mott Childrens Hospital were assessed.

Methods: The study is a retrospective, descriptive study of pediatric patients treated with plerixafor for PBSC mobilization for autologous transplantation after high-dose chemotherapy. The study population consisted of pediatric patients less than 18 years of age with histological confirmed malignancies who required high-dose chemotherapy and were treated with plerixafor to mobilize stem cells to peripheral blood for collection are included in the study. The patients included in the study have received G-CSF (10 20 mcg/kg) daily prior to aphoresis. The relevant data were exported into Microsoft Excel 2010 and the mean and SD calculated using the functions in Excel. Baseline demographics and clinical characteristics of age, sex, diagnosis and mobilization strategy and comorbidities would be presented in a table with number of patients belongs to each. Demographic data were analyzed using descriptive statistics (means and standard deviations (SD) would be presented for all continuous variables; percentages would be presented for nominal data). Individual treatment parameters would be presented for each patient in table format. Clinical outcomes of each patient for the diagnosis would be reported alongside patients treatment parameters.

Results: 10 subjects were qualified for inclusion in this study. The malignancies of the subjects consisted of germ cell tumor, Ewing family tumors of bone, hepatobiliary, neuroblastoma, nodular lymphocyte predominant Hodgkin's lymphoma, nodular sclerosis, and medulloblastoma. One subject were excluded due to missing infer form patient's electronic medical record. One subject received one plerixafor dose, four received two doses, three received three doses, and one received four doses. All the subjects who received plerixafor also received GCSF doses for mobilization. 56 percent of the subjects achieved the goal of number of cells collected from aphresis; 22 percent did not achieve the goal of number of cells collected; and 22 percents (n = 2) had no data. 89 percent of subjects had successful engraftment of neutrophils.

Conclusion: Plerixafor administered with GCSF increased the number of peripheral blood progenitor CD34+ cells collected from PBSC mobilization for aphoresis when used in patients who were not able to collect sufficient CD34+ cells in previous tries.

4-123

Category: Pediatrics

Title: Use pattern of Non-steroidal anti-inflammatory drugs in ambulatory pediatric patients in a municipal hospital in Taiwan

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Purpose: Non-steroidal anti-inflammatory drugs (NSAIDs) are often used clinically for fever, pain or inflammation relief in pediatric patients. However, there are limited clinical studies on the use of NSAIDs in pediatric patients; hence, the goal of this study was to examine the prescribing pattern of NSAIDs in the ambulatory pediatric patients in hope of finding useful information that can be considered in the future pediatric guideline for NSAIDs uses.

Methods: This retrospective study collected the NSAIDs usage data (excluding external use dosage forms) by children under 12 years old in the ambulatory setting during 2014. Basic information collected included the gender, age, diagnosis, the generic name of the NSAID, the dosage forms used, and the specialist seen. Descriptive statistical analysis would be utilized and the average daily dose would be used to evaluate the appropriateness of the prescription.

Results: There were a total of 387 patients who were less than 12 years old enrolled in the study. The average age of the patient was 4.93.2 years old, and the majority of patients were between 2 to 6 years old (49.4%). There were 604 NSAIDs prescriptions ordered during the study period with the average duration of treatment of 2.591.63 days. The main dosage form prescribed was oral liquid form followed by suppositories (24.9%) and one case of injection. The first generation NSAIDs such as Ibuprofen (72.1%) and Diclofenac (26.2%) accounted for 99.8% of the prescriptions. There was one case where the second generation NSAIDs (Etoricoxib) was used. In this study, the most common diagnosis for NSAIDs use was for the treatment of respiratory conditions (ICD-9-CM codes:460-519F44.8%) and fever related symptoms (ICD-9-CM codes:780-799F37.3%). The prescribers were mostly pediatricians and ENT specialists (94.1%). In terms of prescribing pattern, 81 prescription orders had two NSAIDs, and 83.3% was ordered as PRN. After detail evaluation of the prescriptions, 89 prescriptions were found with invalid indications, 10 prescriptions had inappropriate dose and 2 were redundant orders.

Conclusion: In this study, physicians tend to choose ibuprofen which is relatively safe as the primary treatment choice. Interestingly, 14.7% of the prescriptions in our study were without a valid indication. Although the cases of incorrect dose or redundant orders were relatively few, these mistakes can potentially harm the patient and hence deserve special attention. In the future

study, dosage used, patient weight, prescription indication, dosage forms, the type NSAIDs used should be examined together in order to have a more comprehensive study.

4-124

Category: Pediatrics

Title: Reducing waste and cost of producing oral syringes in a pediatric hospital

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Purpose: In pediatric hospitals, medications are dispensed via oral syringes in a variety of doses for the diverse patient population. The challenge is to provide enough syringes to fulfill active therapy while managing expenses and waste. To supply these oral syringes, practice had been to produce three to four days of therapy utilizing the active therapy report. Discontinuation of therapy led to the accumulation of oral syringes that would expire and result in considerable amounts of wasted medication and money. The aim of this project was to redesign the practice of preparing oral syringes to reduce waste and cut costs.

Methods: At the onset of the project, all expired medications had been discarded, and the original practice of filling oral syringes for three to four days based on daily active therapy was continued. For two weeks in February, expired oral syringes from the central pharmacys active, inactive, and refrigerated therapies were removed and documented. Thereafter, a new practice of filling active therapy oral syringes was implemented. The amount of oral syringes prepared was reduced from a three or four days stock to a twenty-four hours stock. After a month of implementation, unused oral syringes were collected from the inpatient floors within twenty-four hours of discontinuation and documented for an additional two weeks in April.

Results: The impact was measured by comparing the two weeks before and after the change in procedure. The number of unused doses and syringes, as well as the cost of the wasted drug and syringe was collected to quantify the expense and waste. The most dramatic reduction was the number of syringes wasted and the cost of drug wasted. As a result of the new procedure, the number of oral syringes wasted in two weeks decreased from 9,586 to 1,682. Furthermore, the cost of wasted drug dropped from $13,539.38 to $2,413.26. Overall there was a total cost savings of $12,587.76. Along with the reduction in waste and cost, it was found that our pharmacists and pharmacy technicians spent less time in the production of oral syringes. When discussing the change in procedure, it was a concern that more time would be needed to meet the demands of daily active therapy. However, the staff has been able to finish faster, and this has allowed them to focus on other responsibilities.

Conclusion: Due to the pediatric patient population, the pharmacy of Childrens of Alabama is accountable for dispensing oral syringe medications in various doses. To lessen cost and waste of

medication, the amount of oral syringes produced at a time was condensed from a three to four day supply to a twenty-four hour supply. Based on findings, Childrens of Alabama achieved the goal of reducing waste and cost without additional burden to the staff.

4-125

Category: Pharmacy Law / Regulatory / Accreditation

Title: Characterization of the boxed warnings in package insert of prescription medicines in Japan.

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Purpose: In Japanese Pharmacists Act, pharmacists shall provide necessary information and guidance for the patient based on pharmaceutical knowledge and experience for ensuring proper use of the medicine dispensed. The package insert is one of documents to be referred when providing those information and guidance. The boxed warnings in the package insert including caution and demand are the most significant parts; however, the suitability of boxed warnings has not been evaluated. The aim of this study was to characterize the warning description in package insert of prescription medicine in Japan.

Methods: Package inserts of prescription medicine listing in the National Health Insurance drug price list on March 1st 2015 were collected from the website of Pharmaceuticals and Medical Devices Agency in Japan. Package insert with boxed warnings were classified according to the Standard Commodity Classification Number of Japan based on pharmacological activity of each medicine. They were also compiled according to their formulations. The boxed warnings were divided to caution and demand parts, and characteristics of them were compared between medicines.

Results: More than 14,000 of package inserts were found. 9.3% of package insert had the boxed warnings. Boxed warning were shown in package insert of internal medicine, injections, and external medicine, in descending order. Description of adverse drug reaction consisted of 81% of all cautions. The percentages of the adverse effects on the liver, kidneys, and bone marrow were 14, 4, and 12, respectively. Most of the cautions were observed in warning box of agents affecting cellular function. Demands in boxed warnings to the medical doctors, pharmacists, and other medical staffs accounted for 100, 80, and 10% of all package inserts with boxed warning, respectively. Demands were for the hospital facilities, explanation for patients, patient selection, examination, and therapeutic drug monitoring, in descending order. Demands were also frequent on package insert of agents affecting cellular function. Several warning descriptions had only either caution or demand and may be hard to be understood by medical staffs.

Conclusion: This is the first report on characterizing boxed warnings in the package insert of prescription medicine in Japan. The most of the boxed warnings needed pharmacists to therapeutic contribution, and their descriptions were consistent in Pharmacists Act. Therefore, the boxed warnings are useful for pharmacists in providing the patient with necessary information and guidance based on pharmaceutical knowledge and experience. However, some descriptions in boxed warnings might be insufficient, and proper revision of package insert will make up for the deficiency.

4-126

Category: Pharmacy Law / Regulatory / Accreditation

Title: 340B contract pharmacies key elements and best practices: Establishment of a 340B contract pharmacy program with standard processes, resources, and compliance audits.

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Purpose: An assessment of our growth in 340B contract pharmacy arrangements identified a need for consistent methodology and standard processes to ensure continuous monitoring and program compliance. This case provides successful strategies in tackling multiple key areas and potential pitfalls in the 340B contract pharmacy arrangements such as vendor arrangements, HRSA (Health Resources and Services Administration) requirements, auditable records and ultimately the accountability of the 340B covered entity.

Methods: The team consists of organization leaders, Informatics leaders, and a 340B program specialist. The team developed consistent process for identification, selection, and implementation of 340B contract pharmacies. Key elements of program compliance were also reviewed and developed by the team. This included vulnerable areas and potential pitfalls such as accurate contracts, HRSA database, wholesaler accounts, 340B contract pharmacy locations, dispensing transactions, replenishment transactions, 340B software use, and self-audits.

Results: The fundamentals of both the implementation and compliance processes were developed and implemented to meet regulatory requirements. The addition of a 340B program specialist with established responsibilities provided ongoing oversight of the program. Policy and procedures outline the regularly scheduled compliance audits. The key elements of compliance were addressed and the team will continue to focus on future regulatory guidance.

Conclusion: The implementation of a policy, standard processes, and a compliance program is critical to ensure program success and compliance. Establishing the role of a 340B program specialist provides a consistent resource and oversight of the 340B contract pharmacy program.

4-127

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Early access to eculizumab improves clinical outcomes and reduces in-hospital resource use in patients with atypical hemolytic uremic syndrome (aHUS)

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Purpose: We examined if clinical outcomes and hospital resource use are improved by early use of eculizumab in patients hospitalized with aHUS, a life-threatening, genetic disease characterized by uncontrolled complement activation. Eculizumab is a humanized monoclonal antibody approved for aHUS treatment in 2011. Plasmapheresis was the standard of care for aHUS prior to eculizumab's approval and continues to be used in many aHUS patients despite eculizumab's high efficacy.

Methods: This study used the Premier database, a geographically diverse U.S. database containing inpatient and hospital outpatient data for over 350 million patient encounters. It contains standard hospital discharge files and information on billed services. The analysis period was October 1, 2011 to September 30, 2013. Inclusion criteria: 1) inpatient hospitalization with an ICD-9 diagnostic code for hemolytic uremic syndrome (283.1x) and/or thrombotic microangiopathy (446.6); 2) eculizumab use during that hospitalization (index). For patients with multiple HUS/TMA hospitalizations with eculizumab use, the first was the index. To include only patients initiating therapy for an acute HUS/TMA episode, patients receiving eculizumab in an outpatient setting within 6 months preceding index hospitalization (washout) were removed. Patient classification: 1) Early Initiators (received eculizumab within 7 days of index hospitalization, with no HUS/TMA hospitalization in the washout period); 2) Late Initiators (received eculizumab Day 8 or later of the index hospitalization, OR had an HUS/TMA hospitalization during the washout period but received no eculizumab during that hospitalization). A clinical expert reviewed 45 de-identified chargemaster files of patients meeting inclusion criteria. Based on laboratory test patterns, medications, procedures and other indicators, 42 probable aHUS cases were identified and included for analysis (12 Early Initiators, 30 Late Initiators).

Results: Early Initiators were younger than Late Initiators (27.8 versus 42.9 years; P 0.054). Groups otherwise had similar demographic and hospital characteristics. There were three deaths, all in the Late Initiator group. Although Late Initiators had significantly longer lengths of stay than Early Initiators (mean 30.8 versus 15.3 days, respectively; P 0.03), perhaps owing to study

design, time from first eculizumab administration to discharge was similar between groups (mean 12.1 days for Late Initiators versus 10.9 days for Early Initiators; P 0.718). Late Initiators were more likely to have plasmapheresis before eculizumab (83.3 percent versus 50.0 percent of Early Initiators; P 0.049) and tended to receive it for more days before eculizumab initiation (mean 11.4 versus 4.2 days for Early Initiators; P 0.149). Although not statistically significant, among patients on dialysis at some point during their hospitalization, 5 of 6 Early Initiators (83.3 percent) were off dialysis by discharge compared to only 8 of 19 Late Initiators (42.1 percent; P 0.16). Dialysis discontinuation is an important indicator of outcome, as renal failure is a major clinical manifestation of aHUS. Readmission rates were not significantly different, but trended higher for Late Initiators (33.3 percent versus 16.7 percent for Early Initiators; P 0.453).

Conclusion: These results suggest that early initiation of eculizumab in patients hospitalized with aHUS improves patient outcomes and reduces in-hospital resource use and length of stay. Though not statistically significant, the difference in discontinuation of dialysis is noteworthy. Future research aims to replicate this study with a larger sample to support the trends observed here.

4-128

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Lock, Stock & Flow Improving the supply of Controlled Drugs in the MMUH

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Purpose: The supply of controlled drugs, or MDAs, is subject to strict legislative control. 71 preparations are used in the MMUH. When supplies are unavailable a nurse must get them from Pharmacy. This has a negative impact on direct patient care and leads to work flow interruption in the Pharmacy. A scheduled electronic pick-up and delivery service offered by Pharmacy accounts for 19% of MDAs supplied. Aim/Objective: Reduce the number of occasions the nurse leaves the patient to collect MDAs by 25%, thereby reducing the number of interruptions to Pharmacy work flow.

Methods: Using Lean Methodology we analysed the supply of MDAs in the MMUH in the following way: Define: A process map was produced, and stakeholders and drivers were identified Measure: The unscheduled nurses visits to the Pharmacy Department were measured and a Gemba Walk of the porter pick up and delivery service was undertaken. Analyse: The reasons for unscheduled visits were reviewed. Improve: A two week pilot of an extended and rescheduled MDA pharmacy service was run on 2 wards. Control: The project was designated for hospital-wide roll out

Results: Therer were 216 visits to Pharmacy relating to MDAs over a 10 day period That equated to 17 nurse visits per day; and 20 minutes of time per visit There was a cost of Euro 7.14 assocaited with each nurse visit The reasons for the unscheduled visits were analased and the following reasons were noted: Insufficient ward stock 27% MDA newly prescribed / new patient 45% Unknown 17% Others 11% The pilot saved 2.25 hours of nursing time on 2 wards over 2 weeks and reduced pharmacy work-flow interruptions by 46%.

Conclusion: The introduction of a 5 day porter MDA collection / delivery service could reduce the amount of nurse time away from direct patient care for MDA retrieval. This study suggests that this would save 58.5 nursing days (28,964) hospital-wide in 1 year. This will reduce pharmacy interruptions for supply of MDAs and risk of error, a positive outcome for patients, staff and hospital.

4-129

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Frequency and Risk factors for Intravenous (IV) Compounding Errors in a Pediatric Hospital

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Purpose: The American Society of Health-System Pharmacists (ASHP) encourages hospital and health-system pharmacies to incorporate bar-code scanning in all stages of medication use process, including dispensing. The automated intravenous (IV) workflow management system, DoseEdge, which utilizes bar code scanning and imaging technologies, has been shown to effectively detect errors beyond those identified by pharmacists alone. However, the risk factors leading to IV compounding errors have not been previously analyzed or quantified. As such, the objectives of this study were to determine the frequency and risk factors for IV compounding errors in a pediatric hospital.

Methods: Data from March 2013 to February 2014 from a Pediatric Hospital were analyzed from an IV workflow management system to identify IV compounding errors and their associated risk factors. The IV workflow system includes a pharmacist inspection to confirm these errors or identify new ones. A descriptive analysis was conducted to determine the error rate. The relationship between compounding error and potential risk factors were examined using logistic regression.

Results: In total, 3,170 errors (0.74%) out of 430,179 doses were detected and documented. Pharmacist inspection was necessary to catch 27% of all errors, mainly including volume (20.38%) and product damage errors (0.91%). The IV workflow management system captured the remaining 73% of IV compounding errors, which mainly identified drug and diluent errors, prior to the pharmacists inspection. Using the backward stepwise procedure, the logistic regression model showed staff shift, patient care areas, day of the week and the staff member compounding the IV preparation to be significant risk factors for IV compounding errors. Of these factors, morning shifts (OR=1.85, 95%CI 1.69-2.03), critical care units (OR=1.17, 95%CI 1.07-1.28), Sundays (OR=1.22, 95%CI 1.05-1.40), and having a technician compound the IV preparation (OR=1.17, 95%CI 1.04-1.32) had the highest error rate.

Conclusion: A 0.74% IV compounding error rate was detected. Pharmacist identified 27% of these errors, with the remainder identified by the IV workflow management system. Staff, shift, patient care areas, day of the week and the staff member compounding the IV preparation were identified to be significantly associated with IV compounding errors.

4-130

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cost of care and outcomes for surfactant-treated premature infants with Respiratory Distress Syndrome: a retrospective analysis

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Purpose: Respiratory distress syndrome (RDS) in premature infants is due to surfactant deficiency. There is a paucity of data on the cost of care comparing the natural surfactants available in the United States to treat RDS: beractant (BE), calfactant (CA), and poractant alfa (PA). The aim of this study was to evaluate, in premature infants diagnosed with RDS, the associations between these three surfactant treatments and hospital costs, as well as neonatal intensive care unit (NICU) length of stay (LOS), mechanical ventilation use (MV) on hospital days 3 and 7, and NICU mortality.

Methods: Data for the study were derived from the statistically de-identified Premier Research Database which currently contains approximately one in every five hospital discharges in the United States. The study included all infants born in the hospital from January 2010 through December 2013 with a RDS diagnosis, gestational age (GA) 25-36 weeks, and birth weight (BW) ≥500 grams, who were ≤2 days old on the day of first surfactant administration in a Level III or Level IV NICU. Infants were excluded if they received more than one surfactant or had any serious congenital anomaly. Infants were grouped according to which of three natural surfactants was used: BE, CA, or PA. The analyses focused on the initial NICU period during the identified hospitalization. Costs were standardized to 2013 US dollars. Outcomes were modeled using hierarchical multivariable regression to account for patient and hospital-level confounding variables, including patient demographics, severity of illness, risk of mortality, hospital characteristics and the center effect.

Results: A total of 19,342 surfactant-treated inpatient newborns with RDS were identified. Of those, 13,240 meeting inclusion/exclusion criteria were analyzed. Among these 4,136 (31.2%) received BE, 2,502 (18.9%) received CA, and 6,602 (49.9%) received PA. There were no differences in GA and BW among the three groups. No significant differences between groups were found in adjusted mean total costs (all $p>0.05$), which also included the cost of surfactant: BE $50,929 (95% confidence interval [CI] 46,092-56,274), CA $50,785 (95% CI 45,060-57,236), and PA $50,212 (95% CI 45,716-55,150). Also adjusted mean NICU LOS days were not significantly different (all $p>0.05$): BE 26.7 (95% CI 24.4-29.1), CA 27.8 (95% CI 25.2-30.8), and PA 26.2 (95% CI 24.0-28.5). Compared to PA, BE and CA were associated with

greater odds of mechanical ventilation use at day 3 (Odds ratio [OR]=1.56 [95% CI 1.32-1.84] and OR=1.60 [95% CI 1.28-2.00], respectively) as well as at day 7 (OR=1.39 [95% CI 1.16-1.67] and OR=1.28 [95% CI 1.01-1.61], respectively) (all $p<0.05$). Adjusted NICU mortality was significantly higher with CA versus PA (OR=1.51; 95% CI 1.08-2.11, p=0.015), with no other significant differences between the groups (BE versus PA, OR=1.09; 95% CI 0.81-1.48, p=0.567; BE versus CA, OR=0.72; 95% CI 0.51-1.02, p=0.068).

Conclusion: This large retrospective database study found no significant differences in total costs and NICU LOS between the three surfactant cohorts after adjusting for confounding covariates. Despite the similarities in these outcomes, fewer infants receiving PA were likely to be on mechanical ventilation by day 3 or by day 7. In addition, PA treatment was associated with lower odds of mortality compared to CA, as reported in previous studies. This analysis provides insight into the costs and outcomes of real-world surfactant use and may assist pharmacists and physicians with treatment decisions that improve outcomes for premature infants with RDS.

4-131

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Establishing residency programs in small and rural hospitals: creative funding and business planning

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Purpose: In the 2015 American Society of Health-System Pharmacists (ASHP) resident match program for post graduate year 1 (PGY1) pharmacy programs, there were 4358 applicants for only 3081 positions. There is a need for additional residency positions and small and rural hospitals represent an excellent opportunity for residency program expansion. Without the resources of a large integrated health system or academic medical center, justifying the residency program through a business plan is often the first step to make the program a reality.

Methods: Presentations were developed and delivered to senior health system leaders to highlight the role of pharmacy within the organization and the need to develop a residency training program. A 5-year business plan based on estimated Medicare funding and new residency associated cost savings projects demonstrated financial viability for a new program in a small community hospital. Cost savings methods included formulary management projects and staffing optimization. Also in the business plan were the non-financial benefits of a residency program such as the potential to improve quality measures, patient satisfaction, and alignment with readmission reduction strategies.

Results: Using the previously discussed methods, University Hospitals (UH) Geauga Medical Center received approval from hospital administration to begin a PGY1 residency with one resident and then grew it to two residents the following year. A PGY2 residency in internal medicine and academia was added the following year for three new resident positions in the same number of years. With updated business plans and new justification strategies, UH Richmond Medical Center received approval and will start with 2 PGY1 residents in 2015 and UH Ahuja Medical Center will have 1 PGY1 resident in 2015. All of the hospitals have an average daily census under 150 patients per day.

Conclusion: Though barriers to initiating a residency program in a small or rural hospital do exist, the process begins with increasing hospital leader awareness of the importance of the role of the pharmacist and then forming and presenting a business plan. An understanding of residency funding, business planning and creative approaches to cost savings is critical for overcoming the first hurdle to residency program initiation in a small or rural hospital.

4-132

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Effect of interventions by pharmacists in dyslipidemia patients

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Purpose: Dyslipidemia is a chronic disease with few subjective symptoms, and thus, it is not uncommon for patients to decide on their own to discontinue medication. Improving the adherence to treatment of such patients and maintaining the treatment effect is a major issue. We investigated the effectiveness of pharmacist intervention using information technology (IT) and a patient guidance tool in patients taking rosuvastatin.

Methods: The subjects were patients who had been prescribed rosuvastatin between February 2013 and April 2014 (intervention group: 46 patients, control group: 53 patients). Pharmacists advised subjects in accordance with a care plan schedule using iPads with a patient guidance tool. Medication adherence, the rate at which subjects were asked about their serum lipid levels, and subjectsf rate of success with their serum lipid level were assessed.

Results: The percentage of patients with good adherence each time they visited the pharmacy (mean adherence maintenance rate) was significantly higher ($p < 0.01$) in the intervention group (86.2%) than in the control group (72.9%). The percentage of patients who did not have poor adherence at any visit during the intervention period (cumulative adherence maintenance rate) was also significantly higher ($p < 0.01$) in the intervention group (45.5%) than in the control group (26.0%). The rate at which subjects were asked about their serum lipid levels rose significantly ($p < 0.01$) during the intervention period compared with before the intervention period, and high rates of success were maintained for low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and triglyceride (TG).

Conclusion: Active intervention by pharmacists using IT and patient guidance tools led to improved patient adherence. Specific guidance from pharmacists using data obtained while

monitoring serum lipid levels led to adherence maintenance and high rates of success with target levels.

4-133

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Appropriateness of self-perceived teaching proficiency as a measurement of teaching certificate program effectiveness within post-graduate training programs

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Purpose: To determine if self-perceived teaching proficiency obtained from a teaching certificate at the end of post-graduate training is appropriate to measure program effectiveness and if the teaching certificate program influenced the decision to choose academia as a career.

Methods: Pharmacy Practice faculty from US Schools and Colleges of Pharmacy were surveyed to determine teaching activities included in teaching certificate programs from a list of 21 teaching activities, if they felt their teaching certificate prepared them to conduct the teaching activities by the end of the program, and to indicate if, after one year in academia, they continued to believe the teaching certificate program prepared them to perform the teaching activities.

Results: There were 1,620 faculty surveyed and a 32% response rate. The self-perceived ability at the end of residency compared at two time points (directly at the end of residency and retroactively after one year in academia) was similar for 15 of the 21 skills. Self-perceived ability at the one year time point was significantly higher for four skills ($p<0.05$): writing a course syllabus, developing a grading rubric, writing an experiential rotation syllabus, and serving as a student advisor. Self-perceived abilities for two skills was significantly lower when comparing the two time points: incorporating active learning and delivering a lecture. Seventy percent of respondents reported the teaching certificate program influenced their decision to choose a career in academia.

Conclusion: Self-perceived ability to perform teaching skills measured immediately at the end of teaching certificate programs is similar to self-perceived ability measured at the end of one year in academia indicating self-perception of ability is an appropriate measure of teaching certificate program efficacy. Greater emphasis on skills involving delivering a didactic lecture and incorporating active learning seems warranted.

4-134

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Comparisons and Cost Analysis of Post-Marketing Adverse Drug Reactions for GLP-1, DPP-4, and SGLT2 Type 2 Diabetes Medications

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Purpose: Adverse Events (AEs) observed during homogenous pre-approval clinical trials frequently do not correlate to AEs observed in post-approval, real-world, patients. Accordingly, on-going monitoring of post-marketing data is vital for determining drug safety. FDA maintains a large collection of post-marketing AE reports in their Adverse Event Reporting database (FAERS). ~1,500,000 reports are currently being submitted each year. Substantial costs are associated with these AEs and they represent a significant burden on the healthcare system. Improved analysis of post-marketing AEs combined with the quantification of downstream AE and outcome costs might provide an improved method for assessing real-world safety and financial impact.

Methods: 87,340 post-marketing primary suspect FAERS case reports were analyzed. Duplicate cases were removed. Part one of the study used the Reporting Odds Ratio (ROR) to measure disproportional reporting rates across numerous AEs that represent significant safety issues and can affect medication adherence. Part two of the study estimated the costs associated with post-marketing AEs and poor patient outcomes for each drug by: 1) obtaining all FAERS reports for each drug from 2010-2014, 2) mapping ICD-9 codes and AHRQ-derived survey costs to MedDRA outcome and AE terms, and 3) using drug usage data to calculate downstream costs per prescription. These analyses only included Important Medical Events (defined by EudraVigilance). Additionally, only the highest individual AE or poor patient outcome cost was used for each report.

Results: Part one: most of the elevated ROR results for cardiac- and cerebral-related AEs were associated with DPP-4 drugs. Pancreatitis, pancreatitis acute, adenocarcinoma pancreas, and pancreatic cancer were strongly associated with almost all of the members of the DPP-4 and GLP-1 classes (with numerous RORs in the 20 80 range). Elevated reporting rates for hypoglycemia were observed for all DPP-4 drugs (highest RORs included: 10.85 sitagliptin and 10.40 for sitagliptin/metformin) but only noted in select members of the GLP-1 and SGLT2 classes. While all drug classes had members with elevated reporting for diabetic ketoacidosis, the SGLT2 inhibitors had much higher RORs than the other two classes with 63.77 for canagliflozin and 19.61 for dapagliflozin. As expected, elevated reporting for genital related infections was only evident in the SGLT2 class. Part two: the top 3 highest downstream costs did not show any

class-specificity as they were associated with dapagliflozin (SGLT2) $20.00 per prescription, exenatide (Byetta) (GLP-1) $18.64, and alogliptin (DPP-4) $14.60.

Conclusion: AEs and poor outcomes that occur during a drugs post-marketing phase often represent both significant safety and medication adherence concerns and result in large cost burdens for the healthcare industry. We focused this analysis on Type 2 diabetes as it increases risk for serious coronary, kidney, nerve, and other complications in over 200 million people. AEs associated with drugs intended to treat diabetes are important to quantify and understand because strict medication adherence is needed to reduce the complications listed above. The results of this analysis showed interesting safety and cost differences both within- and across diabetes medication classes.

4-135

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of reduced patient to pharmacist ratio and enhanced pharmacist teaching on HCAHPS scores and readmission rates on a medical-surgical unit

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Purpose: The objective of this pilot program was to examine the effect of transitioning from a 90:1 to a 30:1 patient to pharmacist ratio on a medical/surgical hospital unit on 30-day readmission rates and HCAHPS performance scores related to communication about medicines.

Methods: A restructuring of traditional pharmacist responsibilities was undertaken in order to provide more direct patient care which included: reconciliation of admission, inpatient, and discharge medications on all patients; counseling of patients starting new medications; identification of patients at high risk for readmission and provision of more in depth discharge reconciliation and counseling; attendance of nursing huddles to gain perspective on social, nursing, and new medication issues with the patient. Pharmacists continued participation in collaborative rounds with the medical team. After four months, HCAHPS data derived from Press Ganey surveys returned by discharge unit, and acute 30-day readmission rate derived from hospital reported rates we compared with data from the previous five month.

Results: In the four months since implementation, over 300 patients received direct pharmacist medication counseling. Compared to the first five months of fiscal year 2015, the HCAHPS scores related to communication about medicines increased by 55% in the subsequent four months. Thirty-day readmissions, on average, were unchanged.

Conclusion: Pharmacists providing more direct patient care in an inpatient medical/surgical unit using a 30:1 patient to pharmacist ratio can improve HCAHPS scores in the communication about medicines domain. Additional interventions are required to impact readmission rates.

4-136

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Economic impact of switching from individual patient supply of 3 mL pens of insulin aspart to floor stock of 3 mL vials of insulin lispro

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Purpose: Two approaches to deliver insulin in a hospital setting are individual patient supply and floor stock. In individual patient supply, each insulin vial or pen is used by only one patient; whereas in floor stock dispensing, one insulin vial is used to provide one-time unit dose insulin to multiple patients as needed. The objective of this retrospective study was to evaluate the wastage of rapid acting insulin and assess the economic impact of switching from individual patient supply of 3 mL pens of insulin aspart to floor stock dispensing of 3 mL vials of insulin lispro in a hospital setting.

Methods: Roper St. Francis Healthcare (RSFH) is a healthcare system in Charleston, SC, composed of three hospitals: Roper Hospital (368 beds), Bon Secours St. Francis Hospital (204 beds), and Roper St. Francis Mount Pleasant Hospital (85 beds). In April 2012, RSFH converted the rapid acting insulin dispensing process from 3 mL pens of insulin aspart dispensed individually to patients to be used for the duration of their hospital stay to a unit dose floor stock method in which nursing staff prepared one-time use rapid acting insulin doses from automated dispensing machine sequestered 3 mL vials of insulin lispro on an as needed basis. Pharmacy purchasing and patient-level rapid acting insulin billing and utilization data were available from September 2010 to December 2012. A regression model was utilized to analyze insulin wastage and estimate the associated acquisition costs. Insulin wastage is defined as the difference between insulin dispensed by the pharmacy and insulin administered to patients. Covariates include the number of patients treated, mean time on treatment, mean daily dose, and mean Charlson Comorbidity Index.

Results: The regression analysis indicates that the conversion from individual patient supply of 3 mL pens of insulin aspart to one-time use unit dose insulin lispro dispensed from automated dispensing machine sequestered 3 mL vials on an as needed basis was associated with a significant decrease in insulin wastage at all three hospitals (R-squared=0.9960; adjusted R-squared=0.9949; p less than .0001). The predicted average reduction in wastage per month was 146,279 IUs (95 pct CI: [141,139, 151,420]; p less than .0001) at Roper Hospital; 50,699 IUs (95 pct CI: [44,567, 56,831]; p less than .0001) at Bon Secours St. Francis Hospital; 7,064 IUs (95 pct CI: [1,819, 12,309]; p=.0095) at Mount Pleasant Hospital; and 204,042 IUs (95 pct CI:

[192,325, 215,758]; p less than .0001) at all three hospitals combined. At current average wholesale prices ($90.61 per pen and $72.94 per vial), the reduction in wastage equates to an average savings of $62,742 per month or $106.40 per patient at all three hospitals combined.

Conclusion: Switching from individual patient supply of 3 mL pens of insulin aspart to one-time unit dose insulin lispro dispensed from 3 mL vials as needed in a floor stock method significantly reduces insulin wastage and associated acquisition costs. This analysis focuses solely on acquisition costs associated with insulin wastage, and does not reflect total savings in acquisition costs associated with the conversion. Further research is needed to evaluate the economic impact of mode of insulin delivery in the hospital (from individual patient supply to floor stock) and insulin delivery method (from pen to small vial) in more hospitals.

4-137

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Supply and Demand: Reducing the Time to Complete the Oral Drug Administration Round

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Purpose: In February 2013, MMUH nursing staff spent on average 135 minutes undertaking the 08.00 oral drugs round. Lean methodology was employed to review the timing and safety of this drug administration round. The aim of this study was to review the drug administration round using Lean methodology to; Eliminate non-necessary steps Reduce the time taken Reduce interruptions Provide a safer environment for drug administration

Methods: A surgical ward was the study ward for the project. A process map of the drug administration round was generated. Each step analysed for the value added. Areas for improvement were identified and rated in terms of impact and feasibility. The improvements introduced were; A Do Not Disturb campaign do reduce interruptions Re-organisation of the drug trolley to reduce searching and retrieval time for drugs Checklist for preparing the drug trolley prior to rounds Use of a coloured flag to identify stocking requirements or any other issues with drug charts Use of a standard layout for the drug storage room white board to improve communication

Results: The project was rolled out in May 2013, with re-audits in September 2013 and July 2014. The average time for completion of the 08.00 drug round has decreased by 53 minutes equating to an annual time saving of 99 thirteen hour nursing shifts per ward per year. The time variation in drug round completion has decreased by 14 minutes per round. Total interruptions have increased from the baseline study. Interruptions caused by people have decreased from the baseline study while drug supply interruptions have increased. Ward Clinical Pharmacists indicated that the project has improved the drug supply process and communication between nursing and pharmacy on the ward.

Conclusion: Lean methodology was successfully employed to reduce the time taken to complete the oral drug administration round. The project is now being roll out on other wards across the MMUH campus.

4-138

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Healthcare resource utilization and associated costs of hematopoietic cell transplant recipients: hospital perspective

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Purpose: Hematopoietic cell transplantation (HCT) is potentially a curative intervention for many malignant hematologic disorders. An accurate understanding of the magnitude of the investment around this intervention is critical for informing various treatment decisions and their associated clinical and economic consequences. The purpose of this study was to evaluate healthcare resource utilization and the associated costs of HCT from a hospital perspective.

Methods: Patients who received an allogeneic (allo) or autologous (auto) HCT between January 2009 and September 2013 were identified using ICD-9 codes in the Premier Hospital database. Demographics and clinical characteristics were evaluated, as well as healthcare resource utilization and associated costs, specifically for prescriptions, room and board, laboratory tests, blood bank services, diagnostic imaging services, and chemotherapy/radiation treatment services.

Results: Among our study population (n=4,393; mean age: 50.4 years) of HCT recipients, 1,617 (mean age: 42.5 years) received allo HCT and 2,776 (mean age: 55.0 years) received auto HCT. Of the overall study population 58% were male, and 9% were <18 years of age. Most patients received their HCT in urban (94%), large (600 beds: 66%), teaching hospitals (88%). The HCTs were performed in the following US regions: Northeast (46%), South (35%), Midwest (14%), and West (5%). The mean (standard deviation) length of stay for the initial hospitalizations for HCT was 25 (18) days for the overall study population and 34 (23) days and 19 (9) days for patients who received allo HCT and auto HCT, respectively. Total mean hospitalization costs were $170,461($165,291) and $63,248($56,357) for patients who received allo HCT and auto HCT, respectively. The greatest contributors to total mean hospitalization costs were prescriptions (allo HCT: $53,735; auto HCT: $26,662), followed by room and board (allo HCT: $47,068; auto HCT: $23,916), and laboratory tests (allo HCT: $28,602; auto HCT: $6,810).

Conclusion: Hospital investments for HCT are substantial, with the costs of allo HCT being twice more than that of auto HCT. Continued optimization of HCT care is critical to reduce its healthcare and economic burden.

4-139

Category: Preceptor Skills

Title: Innovative residency readiness elective: student perceptions regarding usefulness and applicability of course.

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Purpose: In recent years, postgraduate residency training has gained more recognition as a vital necessity for pharmacy graduates. In order for students to compete for these sought after residency positions, additional training and education are recommended to better prepare students in the application and interviewing process. In addition, increasing student credentials with research may enhance competitiveness amongst their peers. The purpose of this study was to evaluate student perceptions/assessment (over two consecutive academic years) of a residency readiness course with a focus on research for third-year pharmacy students interested in postgraduate pharmacy residency.

Methods: This was a two credit residency readiness elective available to 64 third-year pharmacy students at a satellite campus. Course instruction utilized lectures, forum discussions, mock interviews and guest lecturers. All students were required to complete a research project and present their results to a local, state and/or national research forum. Prior to conducting research projects, students had to show successful completion of CITI (Collaborative Institutional Training Initiative) and receive IRB (Institutional Review Board) approval. Students completed a pre and post survey to assess perceptions in their ability to apply for a residency position and conducting research. In the survey, a 5 point Likert scale was used (1 equal to not confident, 5 equal to very confident). Statistical analysis was conducted through a paired sample t-test.

Results: Seventeen total students enrolled within the last two consecutive fall academic years, 2013 and 2014. All completed the survey. Following the completion of the course, students reported they felt more familiar with the residency application process (1.88, 95 percent CI, 1.3 to 2.45, p equals 0.0001), more prepared to apply for a residency (1.44, 95 percent CI, 0.82 to 2.05, p equals 0.0002), confident in competing for a residency (1.06, 95 percent CI, 0.4 to 1.72, p equal to 0.0037), and navigating PhORCAS (Pharmacy Online Residency Centralized Application Service) (1.82, 95 percent CI, 1.37 to 2.28 percent, p less than 0.0001). Students were less apprehensive about interviewing for residency positions, preparing a curriculum vitae, choosing the right program and successfully matching with their chosen program, all of which were statistically significant. With regards to conducting research, students were less apprehensive about the IRB approval process (1.06, 95 percent CI, 0.25 to 1.88, p equal to

0.0139), collecting data (0.94, 95 percent CI, 0.27 to 1.61, p equal to 0.0086, and disseminating or presenting final research data (0.82, 95 percent CI, 0.05 to 1.60, p equal to 0.0389).

Conclusion: These results show that third-year students enrolled into a residency readiness course perceive more positive associations with applying for and obtaining a residency position. Students are also less apprehensive about the IRB approval process, collecting data and disseminating their research data. As postgraduate training continues to gain momentum, preparing students for these coveted positions is essential.

4-140

Category: Preceptor Skills

Title: Incorporation of a Pharmacy Practice Model Initiative (PPMI) activity in introductory pharmacy practice experiences

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Purpose: The overarching aim of the Pharmacy Practice Model Initiative (PPMI) is to promote pharmacists as direct patient care providers, and since students are future pharmacists it is essential to increase their awareness of, and include them in, the PPMI process. The purpose of this report is to highlight a PPMI activity that was successfully incorporated into introductory pharmacy practice experiences.

Methods: All first year professional students were asked as part of their institutional introductory pharmacy practice experience to select one of the five goals of the PPMI (from the National Dashboard) and to describe in a one-page report how the hospital practice site in which they were assigned is working to attain the selected goal. Students were also asked to provide their perceptions on successes and barriers, as well as suggestions for further implementation, and to discuss these with their preceptors. Each individual submission was then reviewed by the investigators to determine not only about which goals students selected to report, but also any trends among the hospitals with regards to PPMI implementation.

Results: Over a two-year period 229 students submitted PPMI reports. Of those, 106 (46%) selected to write about Goal #4 (automation and technology), 62 (27%) chose Goal #1 (pharmacist roles, practices, and activities), 25 (11%) chose Goal #2 (expansion of pharmacy technician roles), 19 (8%) chose Goal #5 (leadership and accountability), and 5 students (2%) selected Goal #3 (training and credentials). The remaining 12 students (5%) did not choose one specific goal. Students and preceptors both indicated their awareness of PPMI was enhanced by the activity, and many students were able to provide thoughtful suggestions to preceptors.

Conclusion: Incorporating a reflective activity in institutional introductory pharmacy practice experiences based on PPMI goals can increase student pharmacist awareness and involvement in further PPMI implementation and development. Preceptors and sites may also benefit from continual student engagement and recommendations.

4-141

Category: Psychotherapy / Neurology

Title: High-dose propranolol for the treatment of assaultive behavior in a hospitalized patient with schizophrenia

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Case Report: Antipsychotics, in combination with behavior modification or psychotherapy, are commonly used for the management of violent and aggressive behaviors in patients with psychiatric illness. However, some patients may require additional interventions. Evidence supports the use of beta-adrenergic blockers, particularly propranolol, for the treatment of violent and assaultive behavior refractory to conventional treatment. The majority of the evidence is in patients with organic brain disorders such as developmental disorders, posttraumatic organic brain syndromes, various types of dementia and Huntingtons disease. Limited evidence (a small number of studies and case reports) indicates that propranolol, at doses higher than those recommended for cardiovascular disorders (400-1,440mg/day), may reduce aggressive and assaultive behavior in patients with schizophrenia. One case-series included eight male patients with schizophrenia who received a targeted propranolol dose of 2,400mg/day. The mechanism of action is unknown but it is hypothesized that beta-adrenergic blockade leads to attenuation of central nervous system norepinephrine over activity and a reduction in the effects of afferent adrenergic stimuli in the periphery. The main limitation to the use of propranolol is the potential for adverse effects that include hypotension, bradycardia, dizziness, emotional lability, and exacerbation of bronchospasm. In addition, propranolol should be used with caution in patients with asthma, chronic pulmonary disorders, congestive heart failure, diabetes and thyroid, hepatic, or renal dysfunction. The peripheral adverse effects associated with beta-blockers (i.e., hypotension and bradycardia) appear to peak at a propranolol dose of 280mg/day. This case report describes the use of high-dose propranolol in a 31 year-old male with a diagnosis of schizophrenia complicated by sudden, unprovoked, and very severe episodes of assault precipitated by auditory hallucinations, difficulty handling anger, poor insight and poor judgment. The patient has a long-standing history of psychiatric hospitalizations and was transferred to a long term care inpatient psychiatric facility in November of 2014 after punching staff at a group home. At the time of admission, the patient was receiving propranolol 160mg every morning in addition to a medication regimen that included olanzapine, lurasidone, fluphenazine, clonazepam, and divalproex. The patient has a medical history that includes asthma, hypertension, obesity, type 2 diabetes, dyslipidemia, carnitine deficiency, and QTc prolongation associated with two past trials of clozapine. After admission, he continued to experience assaultive episodes prior to which he described a feeling of blood coming up, rising through his body. In response, a slow upward titration of the propranolol dose was initiated. He

had a twenty-two day period of safe behavior between 2/27/15 and 3/22/15 (propranolol dose 690 to 730mg/day). On 3/23/15 (propranolol dose 740mg/day), he carried out a sudden, unprovoked and very severe assault on a staff member to the extent of an attempted strangulation. The propranolol dose was further increased but after another twenty-two days of safe behavior, he punched a staff member in the face (propranolol dose 780mg/day) on 4/14/15. He has not had an assaultive episode since and is currently receiving propranolol 830mg/day in addition to the previously mentioned psychotropic medications. The order for the propranolol is written so that it is not administered if the patient is experiencing wheezing, shortness of breath, a systolic blood pressure of less than 90mmHg, a diastolic blood pressure of less than 60mmHg, or a pulse rate of less than 60 beats per minute. At his current dose, he has not experienced any adverse effects associated with the propranolol and no doses have been omitted.

4-142

Category: Psychotherapy / Neurology

Title: Tricyclic antidepressant-induced acute urinary retention in a young male patient -- a case report

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Case Report: This case report presents tricyclic antidepressant-induced urinary retention in a young male patient complicated by a clinically significant drug interaction. A 26 year old male presents to clinic complaining of urinary retention that had progressively worsened over the past 6 weeks. The patient has a complicated psychological history significant for PTSD, bipolar disorder, anxiety, recurrent major depression, hepatitis C, and a history of substance abuse including opioid dependence. Desipramine 25mg daily was started for refractory anxiety disorder and panic 6 weeks prior to presentation, in addition to the patients ongoing therapy (suboxone 8/2mg once daily, lyrica 25mg daily, gabapentin 600mg three times daily, and clonidine 0.1mg three times daily as needed). Over six weeks the desipramine was titrated up to 150mg daily, and citalopram 20mg was added on 4 weeks into therapy. Urinary retention symptoms began at the start of desipramine and where mild at the time; however, as the dose of desipramine was tirated up the urinary retention worsened. The urinary retention became acutely worse upon the addition of the citalopram. At presentation the patient complains of abdominal pain, and states that he goes without urinating for 26 hours at a time and may spend 3 hours in the bathroom trying to void. The patient declined catherization. The decision was made to titrate down the dose of desipramine slowly while monitoring improvement in urinary symptoms and worsening anxiety, and to start tamsulosin 0.4mg at bedtime as acute treatment of the urinary symptoms. Monitoring and follow-up with the patient will continue over the next several months to determine the outcome of his condition. This case demonstrates that desipramine-induced urinary retention is not limited to geriatrics and those patients already at risk for urinary retention. Citalopram when added to desipramine has been shown to increase desipramine concentration 14-50%. This case illustrates that the addition of citalopram to desipramine has the potential to cause a clinically significant increase in desipramine levels, enhancing the urinary retention adverse effect.

4-143

Category: Psychotherapy / Neurology

Title: The impact of extended release Pramipexole formulation on the total dose of levodopa for patients with Parkinsons disease

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Purpose: Parkinsons disease leads to resting tremors, rigidity, bradykinesia, and gait disturbances. The main stay of treatment is levodopa (LD). Many studies have showed that Dopamine agonists have comparable therapeutic effect to LD; therefore it can be added to the treatment regimen to decrease the LD dose. Moreover, new studies have showed that extended release pramipexole might help in further reduction of LD dose. Our objective is to compare the total dose of LD in Parkinson patients taking LD with or without immediate release pramipexole with the total daily dose of LD after the introduction of pramipexole ER

Methods: This study was designed as a retrospective study in the Parkinson-Memory and Movement Disorders Center (PMDC) after the approval of the Institutional Review Board. The data collection was conducted from December 2014 till May 2015 from the patients files in the PMDC. Out of 2000 patients screened, 176 patients were enrolled in this study. For each patient, the total daily dose of LD with immediate release the patient maintained on was calculated (LD equivalent dose) and compared to the maintenance total equivalent dose of LD when pramipexole ER was added to the same patient. Then the study assessed the mean daily equivalent dose of LD before and after introduction of pramipexole ER in all patients taking into consideration the age of the patient(less than or greater than 60), UPDRS score (Unified Parkinson disease rating scale less than or greater than 30), and disease duration. Statistical tests used were paired sample T test and ANOVA test

Results: The mean daily LD equivalent dose in all patients was 451.50 mg compared to 402.08 mg after pramipexole ER was introduced, CI 95% [35.28-63.55], p value < 0.001. The difference in the mean total daily LD equivalent dose in patients > 60 years (n= 85 patients) before and after introduction of pramipexole ER was 34 mg, CI 95% [16.16-53.18] p value < 0.001 compared to 63 mg in patients <60 years (n=91) CI 95% [42.07-84.31] p value < 0.001. In patients with UPDRS score < 30 (n=152) The difference in the mean total daily LD equivalent dose was 56 mg , CI 95% [41.32-72.20]p value < 0.001 compared to 20.92 mg for patients with UPDRS score > 30 (n=24), CI 95% [27.32-33.15] p value < 0.844. The mean daily LD equivalent dose in patients taking pramipexole immediate release (IR) (n=123) was 456.76 mg compared to 422.31 mg after pramipexole ER introduced to the same patients. In patients < 60

years, the mean difference in daily LD dose was 38.35 mg compared to 30.17 mg in patients >60 years after pramipexole ER was introduced to the same patients, CI 95% [8.3-52] p value <0.001

Conclusion: The total daily dose of LD is significantly reduced when pramipexole ER is introduced to the same patient. The decrease in the dose is mostly prominent in patients aged less than 60 years with an UPDRS score less than 30. Although we couldnt study the prevalence of side effects before and after the addition of pramipexole ER, patients might benefit from further reduction of LD equivalent dose. The role of pharmacist in this study is to maintain the patient on the lowest effective LD equivalent dose and optimize the treatment therapy

4-144

Category: Quality Assurance / Medication Safety

Title: Tech- Check-Tech (TCT): Accuracy of technicians and pharmacists in verifying automated dispensing cabinet refills

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Purpose: Goal two of the Pharmacy Practice Model Initiative (PPMI) encouraged the reallocation of select distributive tasks to pharmacy technicians where a pharmacists professional judgment is not required. Published studies have demonstrated success with the utilization of validated technicians checking the accuracy of unit dose cart fill replenishment. However, there are no published data evaluating the accuracy of TCT in the setting of automated dispensing cabinet (ADC) replenishment from a medication carousel. Therefore, the purpose of this study was to evaluate the accuracy of a TCT process in the setting of ADC refills utilizing a medication carousel and bar-code

Methods: Over a seven day period validated pharmacy technicians ability to discover dispensing errors within ADC refills was compared to licensed pharmacists. Training materials were modeled after the ASHP and Wisconsin State Board of Pharmacy TCT implementation resources. The training program included an introductory session, hands-on training, examination, and validation of their ability to detect errors. Artificial errors were introduced into each of the batch ADC refills by the study coordinator over the study period. To control for variability in error rate discovery, only errors introduced by the investigator were measured in this evaluation. Errors were classified as incorrect medication, incorrect dosage form, incorrect strength/dose, and expired medication. Error rates were calculated as the number of errors per medication ADC refill line items checked. Based on historical published data, the targeted artificial error rate was 2 percent. Significant difference was to be determined utilizing a Z-score of minus 1.645. The validated pharmacy technician checked the batch run and noted any errors found without removing the discovered errors. The pharmacist subsequently checked the batch, documented and removed errors identified. Before the batch was distributed to the floor, the study coordinator ensured the removal of all artificial errors

Results: : A total of 116 artificial errors were introduced into 5800 medication ADC refill line items. The observed error rates were 0.14 percent and 0.41 percent for the validated pharmacy technician and pharmacist, respectively. The Z-score was determined to be minus 1.14 (95 percent CI minus 0.0075, 0.00198; p-value 0.257). The average time saved for pharmacist was 72 minutes per day (SD plus or minus 17 minutes).

Conclusion: This study demonstrated that error rates were statistically similar between validated pharmacy technicians and pharmacists in the setting of ADC batch refills from a medication carousel incorporated bar-code technologies.

4-145

Category: Quality Assurance / Medication Safety

Title: Feasibility of using trigger tools for routine detecting of ADEs and medication errors

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Purpose: Investigating the incidence, type, and preventability of ADEs and medication errors is a corner stone in quality improvement and preventing patient harm. Hospitals need more effective strategies to identify events that cause or may cause harm to patients. Trigger tools are those indicators resulted as a consequence of events that cause either medication errors or adverse drug events (ADEs).Trigger tools could be used as a method for detecting adverse drug events (ADEs) and medication errors and therefore reduce patient harm. This study evaluate the feasibility of routine use of trigger tools in detecting ADEs and medication errors in hospitals.

Methods: This study was conducted in three phases at a 1200-bed referral hospital includes all medical, surgical and intensive care units for neonates, pediatric and adults in Riyadh, Saudi Arabia. In phase 1, data related to the use of seven triggers were retrieved from the hospital database from January to April 2015 to detect frequency of their use and main users in hospitals. In phase 2, the feasibility of 16 trigger tools were evaluated by group consist of physicians, nurses and clinical pharmacists using 9-point likert rating scale. The evaluation was for routine use in clinical practice to detect ADEs and medication errors. In phase 3, retrospectively, information technology and IV pharmacists collected the recent past 24 hours medications used in hospital from the trigger tools list. The list generated from the hospital database contains patient details, location, the nurse collected the medication, type of order and medication information. Full information was collected from bed site by four last year trained PhrmD students. They start a structured review of specific trigger of clinical records to prospectively document all information related to patient and the reason for using the medication in the trigger tools list using trigger tools data collection form.

Results: Trigger tools that collected by hospital database include for (frequency of use and percentage administered without profiling respectively) dextrose 50% (1215, 84%), pyridoxine HCL inj (998, 0.5%), N-acetylcysteine (65, 92%), naloxone (5, 60%), flumazenil(3, 100%), Phytomenadione (515, 27%). Out of 16 trigger tools evaluated in the second phase, seven were rated feasible to be used in routing clinical practice to detect ADEs and medication errors. These are naloxone, dextrose, vancomycin, fluminazenil, N-acetylcysteine, vitamin k (phytonenadione)

and pyridoxine HCL . From the third phase, a total of 100 ADEs were identified using adapted the trigger tools. Vancomycin trough level of > 5 mg/l, 15 (60%) ADEs detected by Scr > 98 mg/L; Dextrose 50%, 29 (85%) ADEs 16 (47%) hypoglycemia and 13 (38%) hyperkalemia; Stat orders 21 (51%) ADEs using kcl for hypokalemia, Nacl due to hyponatremia, potassium phosphate for hypophosphatemia, iron hydroxide for low Hgb and RBC, and hydrocortisone for allergy conditions associated with anaphylactic shock.

Conclusion: The trigger tools were found effective and feasible to be used in routine clinical practice to detect ADEs and medication errors in hospital setting. They were found to be good quality improvement tool and could be more effective than other methods such as incident reporting or significant event analysis for routine detecting of ADEs and medication errors. More research is required to explore the feasibility and acceptability of using other trigger tools and promote their use in hospitals.

4-146

Category: Quality Assurance / Medication Safety

Title: Utilizing a pharmacist managed database for inpatient HIV antiretroviral medication surveillance

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Purpose: Appropriate management of HIV antiretroviral medications is crucial for effective therapy in the HIV-infected individual. HIV antiretroviral drug regimens are complex and usually managed by an HIV or infectious disease specialist. Upon hospitalization, these patients are often managed by practitioners who are not very familiar or comfortable with these drugs. As medication specialists, pharmacists are well suited to ensure that patients on HIV antiretrovirals are being managed appropriately. The aim of the present report is to describe the utilization and maintenance of an inpatient HIV antiretroviral medication surveillance database by clinical pharmacists at a large, urban, academic medical center.

Methods: The HIV surveillance database is an existing quality improvement database maintained by the infectious disease pharmacist and pharmacy residents who routinely perform HIV medication monitoring. All adult inpatients that are dispensed HIV medications are identified through daily medication dispensing reports. A chart review is then performed and the following data is collected for documentation in the HIV surveillance database: encounter number, name, gender, creatinine level, creatinine clearance, and HIV medication regimen. If information is not able to be obtained through chart review, other means are used to complete data collectionincluding patient interviews and contacting outpatient health care services and providers. The patients clinical information is then assessed for regimen completeness, drug interactions, administration parameters, and appropriate dosing. If necessary, interventions to a patients HIV regimen are made as well as relayed to the patients physician. The nature of the intervention and whether or not the intervention was accepted is documented in the database. For all patients, a note is written and placed in the permanent medical record.

Results: For the 21 month period of August 2013 to June 2014 and August 2014 to May 2015, a total of 528 patients who were dispensed HIV medications were identified, a mean of 25 patients per month. Of the 528 patients identified, 188 patients or 36 percent required interventions to their medication regimen, a monthly mean of 10 interventions. The acceptance rate for interventions made prior to a patients discharge was 96 percent. The most common categories of intervention were dose optimization and renal dose adjustments.

Conclusion: Utilization of a clinical pharmacist-managed HIV surveillance database is effective in identifying and resolving HIV medication variances during an acute hospitalization.

Information from this database can be used to target areas for improvement in the computerized order entry process, verification of medications, and identify the need for ongoing practitioner education.

4-147

Category: Quality Assurance / Medication Safety

Title: Impact of external return-bin based restocking process of automated dispensing machines on the reduction of medication errors at an academic medical center

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Purpose: Automated dispensing machines (ADMs) are used to streamline the medication distribution process. However, inattentive use with passive oversight can present opportunities for errors. The purpose of this study was to evaluate the impact of the change in the process of returning medications to the ADMs and to minimize medication errors associated with the use of the ADMs.

Methods: In January 2015, a new process for returning medications to ADMs was implemented. This new process was in accordance with guidelines set forth by the Institute for Safe Medication Practices and the American Society of Health-System Pharmacists which recommend policies that minimize or prevent nursing staff from returning medications to an ADM in order to minimize error. With the new process, all medications retrieved from the ADM but not used were placed in external return bin. The contents of the return bin were then emptied and reloaded into the ADM by a pharmacist or collected by a pharmacy technician and brought to the main pharmacy to be checked by a pharmacist before redistribution of the medication. The previous process allowed nurses to reload all unused medications into the ADM pocket directly. Our hospitals patient safety event reporting system was utilized to identify all events involving medications incorrectly loaded into ADMs for a period prior to (July 2014 December 2014) and after (January 2015 May 2015) new practice implementation. From this data, monthly refilling/restocking errors were analyzed during the pre- and post-process implementation to assess changes and the effectiveness of the new policy.

Results: A total of 22 incorrect medications in the ADMs were identified for the period prior to new process implementation. The monthly totals of events during this period ranged from 1 to 6 (mean 3.66 +/- 2.07, median 3.50, mode 6.00). A total of 16 incorrect medications in the ADMs were identified for the period after. Monthly totals ranged from 0 to 5 (mean 3.20 +/- 2.17, median 4.00, mode 5.00). Although the period prior had a higher mean number of events (mean difference 0.46) it is unclear whether the policy had impact. With over 20,000 ADM-pockets hospital-wide and over 22,000 refilling transactions per month, the number of incorrect medications represented a decrease of 0.11% of pockets to 0.08%. Using a t-test (t-stat = 0.365,

one-tail p-value 0.362) the result was non-statistically significant and although the period of July-December had a higher mean, the study failed to reject that the true number of events prior to the implementation of the policy was less than or equal to the number of events after. Although this result is non-statistically significant, the study is clinically significant because it identified opportunities for improvement and suggests a trend of progress in decreasing medication errors.

Conclusion: The study supported that the new process could limit the errors from incorrect returns by nurses. It should not be confused that the statistical significance is the size or importance of an effect. Rather, the data shows that while this approach was not strongly supported as effective, there was still a reduction of errors. Although the data does not vindicate the policy, it does suggest that the new process was somewhat effective. Further enforcement and continued monitoring are needed to improve medication management process.

4-148

Category: Quality Assurance / Medication Safety

Title: Pharmacy contribution to the medication reconciliation process at an urban community medical center

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Purpose: Reconciling the home medications of patients admitted to hospitals with the planned procedures, anticipated medication and dietary therapies has been established as a key patient safety driver. The Meaningful Use Program (MU) established by the federal government identified medication reconciliation as one of its principle indicators of success. Achieving the required 50% medication reconciliation target of Phase II of MU posed a problem for our institution. The purpose of implementing

Methods: A description of a pharmacy technician-supported home medication list retrieval and documentation service was developed and presented to the Meaningful Use Governance Committee. It outlined the service where a pharmacy technician would be hired and trained to work in the Emergency Department (ED) and inpatient units. Responsibilities included collecting complete and accurate home medication lists, providing information to a pharmacist for review, entering information into the ED and inpatient clinical information systems and informing nursing of its completion. The pharmacy technician started with ED patients who were going to be admitted and then addressed any inpatients whose home medication lists were incomplete. Due to the urban setting, this effort required use of good conversation skills, translator support technology and contact with patient family members and retail pharmacies. Data was collected on the number of home medication lists collected, the monthly rate of medication reconciliations achieved and Phase II time period to date.

Results: The service was implemented in February of 2015. Daily averages of home medication lists obtained ranged from 6.2 in the first full week to a high of 34.0 in April. MU Phase II data, the percentage of inpatients who had their home medication reconciled, was collected monthly starting in September, 2014. Initially, results were at the 45th percentile while in March they reached the 70th percentile. The period to date data was comprehensive, including all results experienced since the beginning of Phase II. Period to date results were as low as 46.61% in early October but ended at 54.48% (April 13, 2015).

Conclusion: The inherent challenges for nursing and medical staff, such as conflicting time commitments, limited knowledge of medications and unfamiliarity with technology, hindered the completion of medication reconciliation in an accurate and timely fashion. The contribution of pharmacy in obtaining the home medication lists and entering it into the clinical information

systems of ED and inpatient units increased the rate of success well beyond the MU Phase II target,thus improving patient safety.

4-149

Category: Quality Assurance / Medication Safety

Title: Lessons learned from multiple extended computer down times in a small community healthcare system

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Purpose: During the tornado outbreak of 2011, a small healthcare systems computers failed. For six days a manual system was implemented. The processes were not exemplary, though each day lessons were learned and processes improved. In response, the pharmacy added intranet documents to aid the staff in future occurrences. In 2015 the healthcare system went through a perfect storm, losing the backup mirror one day and the entire system mainframe the next. Over the next two weeks, the system experienced extended failures twice and more lessons were learned. This presentation provides information to help others prepare for similar disasters.

Methods: After the initial computer downtime, pharmacy added intranet space which included tools to aid nursing and pharmacy if an extended downtime occurred. The tools included parenteral labels, both specific and generic. Generic labels are used for less common medications and solutions. Other tools included nursing and pharmacy medication administration records (MARs). The final documents were 21 day MARs designed to decrease rewrites. When the computers failed in 2015, preparation was found lacking. Nursing education was insufficient and consistency of documentation was poor. Shortcomings lead to document expansion on the site, production of an intranet space to track census, and expanded education for the staff. The added documents included MARs for use by pharmacy/nursing pre-populated with the more common {non-physician specific} standing orders, an MAR specific to prn medications, as well as a more robust offering of parenteral labels. Three days later the system failed again. Education was complete in some areas, but not others. Preparation was once again found lacking but much improved where education had been completed. The debrief prompted preparation of guidelines for extended downtime. Expansion of pre-populated MARs followed and nursing was instructed to prepare pre-populated MARs specific to their area.

Results: Through each occurrence of downtime, the system learned lessons which lead to improvement and better preparation for future events. The main lesson learned was: if you think something will never happen again, think again. After the initial downtime, people thought that a similar disaster would never happen again, so preparation, debrief, and education were less than optimal. As one would expect, when tested by a recurrence four years later, all were found lacking. The second lesson learned was: if you see something that can be improved during a disaster or shortly thereafter - improve it, dont wait. The modifications made during the 3 days of up-time between the serial computer failures greatly benefitted the pharmacy and all areas that

received education concerning the improvements. Following the third failure, everyone involved was much more receptive to computer emergency preparation. A more heightened sense of urgency lead to the approval of system guidelines for downtime, expanded education, and more serious consideration of process testing.

Conclusion: Please do not take disaster preparedness lightly. It can happen to any facility and can happen again and again. Despite preparation you will probably find weakness in the system. Plan, prepare, and test your downtime processes. A disaster of this type may never happen in your facility, but if it does, everyone will be thankful for the preparation.

4-150

Category: Quality Assurance / Medication Safety

Title: Power of collaboration: state-affiliate pharmacy organization connects with state hospital association to reduce adverse drug events

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Purpose: The Centers for Medicare and Medicaid Services launched the Partnership for Patients (PfP) in 2011. The PfP set two goals: 40 percent reduction in preventable hospital-acquired conditions and 20 percent reduction in complication-related hospital readmissions, compared with 2010. The PfP identified ten core patient safety areas of focus including adverse drug events (ADEs), specifically ADEs related to the use of warfarin, hypoglycemic agents, and opioids. To reduce ADEs statewide, a health-system pharmacists' state affiliate and a state hospital association formed a collaborative as part of the national American Hospital Association-Health Research and Educational Trust (AHA-HRET) Hospital Engagement Network (HEN).

Methods: In 2014 the health-system pharmacists' state affiliate connected with the state hospital association to form a pharmacist-led collaborative to reduce warfarin, hypoglycemic agent, and opioid ADEs. Pharmacists throughout the state participated in the collaborative, along with other healthcare professionals. The collaborative consisted of three in-person meetings. The initial meeting detailed the purpose of the initiative, proposed measures, and data collection. The mid-term meeting focused on overcoming barriers, hospital success stories, breakout sessions for each ADE drug category, and data collection best practices. The final meeting's focus was sustainability and continued motivational strategies. Collaborative members participated in monthly conference calls with varying content. Information was shared among the collaborative by group email and a professional social network. Hospitals submitted retrospective baseline and monthly data for each ADE over a nine month period. Outcomes measured were: percentage of the state's hospitals reporting on each ADE, excessive anticoagulation in patients receiving warfarin (INR greater than 6), hypoglycemia in patients receiving glycemic agents (glucose less than 50 mg/dL), and over sedation and respiratory depression in patients receiving opioids (naloxone administration). State and national HEN outcomes were compared, and both were assessed to determine if the goals for hospital participation and ADE reduction were met.

Results: In late 2014, the national HEN had not met their hospital participation goal of at least 60 percent but did show marked improvement. Fifty-five percent of hospitals reported warfarin ADE data, 39 percent of hospitals reported glycemic agent ADE data, and 47 percent of hospitals reported opioid ADE data. The overall HEN ADE reduction goal of 17.6 percent was met in two of three ADE drug categories. Hospitals reduced warfarin ADEs by 24 percent, glycemic agent ADEs by 11 percent, and opioid ADEs by 23 percent. In comparison to the national HEN, the

state pharmacist-led collaborative initially had less than 20.5 percent of hospitals participating in the HEN reporting overall ADE data. Upon conclusion of the nine-month collaborative, 67 percent of hospitals were reporting warfarin ADE data, and 58.7 percent of hospitals were reporting glycemic agent and opioid ADE data. In regards to the ADE reduction goal, warfarin ADEs were reduced by 25.5 percent (4.87 percent to 3.63 percent), glycemic agent ADEs by 1.9 percent (6.34 percent to 6.22 percent), and opioid ADEs by 48.7 percent (0.78 percent to 0.4 percent) from baseline ADE rates.

Conclusion: A statewide, pharmacist-led collaborative led to reductions in ADEs related to warfarin and opioids. Hospitals throughout the state joined together to exceed the participation goal set by the AHA-HRET HEN of 60 percent of hospitals reporting relating to warfarin ADEs and narrowly missed the goal of reporting glycemic agents and opioid ADEs. Through the work of the collaborative, hospitals were able to exceed the 17.6 percent reduction goal in regards to warfarin and opioid ADEs.

4-151

Category: Quality Assurance / Medication Safety

Title: Implementation of a checklist to ensure appropriate assessments, interventions, and follow-up care for stroke survivors

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Purpose: Individuals who survived a stroke or a transient ischemic attack (TIA) have an increased risk for subsequent cerebrovascular events. It has been suggested that 80 percent of the recurrent strokes can be prevented by a combination of lifestyle modifications, treatment of vascular risk factors and appropriate pharmacotherapy. Hospital pharmacists can play an important role in ensuring that these patients are discharged on evidence-based secondary prevention therapies.

Methods: Based on current stroke management guidelines and recommendations, a Secondary Stroke Prevention Checklist was developed and approved by the Pharmacy and Therapeutics Committee at North York General Hospital, Toronto, Canada. Components of the Checklist include: (1) antithrombotic therapy for secondary stroke prevention, (2) risk factor assessment and interventions, and (3) follow-up issues. The Checklist was completed by the unit pharmacists for all patients discharged from the stroke-medicine unit, except for those who were palliative or deceased, or if admission and discharge occurred during off-hours. A retrospective chart review of patients admitted between November 1, 2013 and April 30, 2014 was completed to evaluate adherence to the tool.

Results: Sixty-eight of the 82 (83 percent) eligible patients had the Checklist completed, of whom 93 percent were discharged on antithrombotics, 85 percent on antihypertensives and 84 percent on lipid-lowering agents. Five patients were not discharged on antithrombotics due to a diagnosis of hemorrhagic stroke. Those who were not discharged on antihypertensives or lipid-lowering agents either had contraindications, or pharmacotherapies were deemed to be unwarranted by the physicians at the time of discharge. Among those with the Checklist completed, follow-up issues were documented in 40 (59 percent) patients. Frequently identified follow-up issues include blood pressure control (28 percent), management of antithrombotic therapy (21 percent), blood glucose monitoring (20 percent), and lipid monitoring (21 percent).

Conclusion: The Secondary Stroke Prevention Checklist assists pharmacists in systematically assessing patients stroke risk factors as well as their secondary prevention therapies. It can serve as a tool for communicating important follow-up issues to healthcare providers in the outpatient setting. Although the adherence rate to tool completion was encouraging, strategies should be

developed to improve the rate to 100 percent. Future steps will aim at disseminating the tool to other hospital units to ensure optimal care for all stroke patients.

4-152

Category: Quality Assurance / Medication Safety

Title: Impact of inpatient pharmacist interventions on chronic obstructive pulmonary disease hospital readmissions

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Purpose: The Centers for Medicare and Medicaid Services (CMS) began measuring baseline data for chronic obstructive pulmonary disease (COPD) hospital admissions for years 2011 through 2013. In an effort to improve COPD-related outcomes and to be prepared for 2014 implementation of COPD CMS core measures, a community hospital enlisted the services of a clinical pharmacist.

Methods: A part-time clinical pharmacist began providing comprehensive COPD services to inpatients in a community hospital. COPD patients were identified through an electronic medical record (EMR) generated list of patients with a history of COPD, manual EMR review of patients with a COPD related diagnoses, and pulmonologists' referrals. All coherent patients identified as having COPD were seen by the pharmacist. The pharmacist provided comprehensive COPD services including patient chart reviews, motivational interviews, and insurance evaluations. Chart reviews assessed medication histories for adherence and evidence-based medication prescribing. The pharmacist addressed disease progression, inhaler technique, adherence, smoking cessation, and when to obtain clinic follow-up to avoid hospital admission during motivational interviews. The patient's financial ability to obtain medications in the outpatient setting was reviewed, and then a tailored plan for medication access was developed. Retrospective baseline data for COPD standard of care in fiscal year 2013 was compared with 2014 to determine the impact of pharmacist COPD interventions after one year. Patients with a COPD hospital admission were included. Patients excluded had a planned readmission, deceased, or left against medical advice. COPD outcomes measured were percent of readmissions within 72 hours, percent of 30-day COPD-related readmissions, and percent of all cause 30-day readmissions.

Results: In fiscal year 2013, 407 patients were admitted to the hospital for COPD, and 294 patients were admitted for the same diagnosis in fiscal year 2014. After one year of pharmacist COPD interventions, there was a 4.2 percent decrease (4.01 percent to 3.84 percent) in readmissions within 72 hours and a 14.7 percent decrease (3.19 percent to 2.72 percent) in 30-day COPD-related readmissions. During that same period, there was a 20.6 percent increase (15.67 percent to 18.9 percent) in all cause 30-day readmissions.

Conclusion: Targeted pharmacist COPD interventions led to a decrease in COPD-related hospital readmissions but did not impact all cause hospital readmissions for COPD patients.

4-153

Category: Quality Assurance / Medication Safety

Title: Medication therapy as a risk factor for hospital-related falls

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Purpose: Fall risk is multifactorial with many intrinsic and extrinsic risk factors. Among extrinsic risk factors identified as contributors to increased risk of fall are medications that cause sedation, orthostatic hypotension, or cognitive or psychomotor impairment. This study sought to determine which classes of medications are associated with an increased fall risk in patients admitted to the hospital, after adjusting for non-medication related risk factors.

Methods: This retrospective, nested case control study was conducted using administrative claims data from two urban acute care facilities in the southwestern United States. Included patients were 1250 adults aged 18 years and older, hospitalized between October 1, 2012 and December 31, 2013, who underwent fall risk assessment using the Morse Fall Scale (MFS) per institutional policy. The MFS is a cumulative score of six items that assesses fall risk, but does not evaluate medication use. Patients who underwent fall risk assessment in the emergency department were excluded as these patients were slated for an observational stay less than 24 hours. Collected data included patient demographics, MFS scores, fall data and medication administration records. A total of 250 falls were recorded over the course of the study. Data was collected in compliance with the Health Insurance Portability and Accountability Act (HIPAA). Each case was matched to four controls based on baseline MFS score and the unit of admission. Conditional logistic regression was used to investigate independent relationships between medication use and fall after adjusting for age and gender. Medications were classified according to the American Hospital Formulary Service (AHFS) 2014 classifications. The health system's institutional review board approved this study.

Results: Increased fall risk was associated with the use of antipsychotics (95 percent CI, 1.050 to 1.924, P equals 0.023) and benzodiazepines (95 percent CI, 1.004 to 1.735, P equals 0.047) following admission, with both classes reporting hazard ratios greater than one. No statistically significant risk increase was found for cardiac medications, muscle relaxants, anticonvulsants, antidepressants, histamine receptor types 1 or 2 blockers, antihypertensives, diuretics, non-benzodiazepine hypnotics, mild analgesics, anticholinergics, narcotics, or non-steroidal anti-inflammatory drugs (NSAIDs).

Conclusion: Use of antipsychotics and benzodiazepines were independently associated with a statistically significant increase in fall risk after accounting for non-medication related risk factors. Patients' medication profiles should be reviewed for the use of these medications when

the fall screening tool employed in a facility does not take into account medication use as a risk factor. Use of these medications should prompt additional counseling, monitoring, and risk reduction interventions for patients admitted to the hospital.

4-154

Category: Quality Assurance / Medication Safety

Title: Comparison of medication errors before and after implementation of a new automated dispensing cabinet system

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Purpose: The purpose of this study is to compare pharmacy error rates related to the use of automated dispensing cabinets (ADCs) before and after hospital implementation of a new ADC system featuring barcode scanning technology.

Methods: Utilizing the hospitals voluntary error reporting system, medication error data involving the previous ADC system were collected and reviewed from October 2005 through November 2014, and error data involving the new ADC system were collected and reviewed from August 2014 through March 2015. Errors were classified according to the following error type categories: pharmacist check errors, expired medication errors, refill/unload errors, and matrix/miscellaneous errors. These data were analyzed for trends over time, and percent error rates were calculated for each month as well as for each year. Charts and graphs were created to compare ADC-related error data before, during, and after implementation of the new ADC system.

Results: IRB approval was obtained. The average ADC-related error rate associated with usage of the previous ADC system was 0.046% compared to an error rate of 0.013% with the new system, representing a 72% reduction in ADC-related errors since implementation of the new ADC system. The greatest decline in errors was seen in the categories of pharmacist check errors and refill/unload errors.

Conclusion: The implementation of a new ADC system featuring barcode scanning technology led to an observed decrease in our hospitals overall ADC-related error percentage.

4-155

Category: Quality Assurance / Medication Safety

Title: Medication reconciliation: Impact of the pharmacist in the community setting on prior to admission medication lists

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Purpose: Patients being admitted to the hospital are a major focus for transitions of care. According to the National Transitions of Care Coalition (NTOCC) , medication reconciliation is an area where pharmacists can improve health care quality, reduce medication errors and enhance clinical outcomes among health care professionals, government leaders, patients and family caregivers. In the literature, it has been demonstrated that a pharmacist can improve the completeness and accuracy of patients medication histories. This analysis was to determine the impact of a pharmacist on medication reconciliation accuracy in a community hospital.

Methods: From January 2014 to November 2014, pharmacists interviewed as many patients as possible when other daily pharmacist responsibilities were completed. Patients selected were admitted in the previous 24 to 48 hours. Information for medication and allergy histories were obtained from the patient, patients family member(s)/caregiver(s), extended care facility records, and/or outpatient pharmacy. Data from medication reconciliation was retrospectively reviewed by searching notes entered into inpatient charts and/or pharmacist communication/productivity interventions in the electronic medical record (EMR). All collected data was stored in a password protected workbook on a secure server. Pharmacy students in their final two years of school were utilized as an extension of the pharmacist. Pharmacy students focused on performing patient medication histories and allergy histories. The pharmacist performed medication reconciliation by making corrections to the prior to admission (PTA) medication list. Our primary outcome is to determine the frequency of clarifications needed per the patients prior to admission list. Our secondary endpoint is to relate the clarifications to cost-avoidance for potential medication errors. Our primary and secondary endpoints will be evaluated with descriptive statistics.

Results: During 46 days over an 11 month period, 190 patients were interviewed to determine the frequency of clarifications needed per the patients prior to admission list (primary outcome). A total of 2423 medication orders were reviewed for these 190 patients. This averaged out to about 12.75 medications per patient. Looking at the types of errors previously mentioned, 1106 total errors were found. This averaged out to 5.8 errors per patient. Allergies were also reviewed for each patient and 18 errors were found for the 190 patients, averaging to 0.09 errors per patient. Breaking down the 1106 total errors, the 8 categories included medication added (216,

20%), deleted or discontinued medication (381, 34%), patient not taking (39, 4%), duplicate entries (80, 7%), multiple problems (54, 5%), incorrect directions (167, 15%), incorrect dose (113, 10%), and missing information (56, 5%). The 18 allergy errors were broken down into allergies/reaction added (14, 78%) and allergies/reaction deleted (4, 22%). Our secondary endpoint included analyzing total cost avoidance for the recommendations that were found during this review. The results collected showed 46% of the medications reviewed had associated errors. The absolute total cost avoidance for this review was $793,125.30.

Conclusion: Medication histories and reconciliations are a very important area of health care that pharmacy can get involved in. With pharmacy helping to create the most complete and correct prior to admission list of medications for patients, the impact that can be made on cost avoidance is great. With adjustments in staffing or responsibilities, pharmacy can improve our patients outcomes when coming to the hospital.

4-156

Category: Quality Assurance / Medication Safety

Title: Implementation and Assessment of Pharmacist Interventions during Transitions of Care for Heart Failure Patients (The PITCH Study)

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Purpose: The purpose of the research was to implement and assess the impact that a pharmacist can have on improving the care of heart failure (HF) patients in terms of reducing readmission due to heart failure exacerbation and/or medication adverse effects. The project was intended to optimize medication therapy during transitions of care, decrease medication errors, increase medication accessibility, improve medication adherence, and empower patients to be more engaged in managing their heart failure. The core research hypothesis was that 30-day readmission rates would be reduced with pharmacist review of heart failure patients' discharge medications.

Methods: A randomized controlled study took place from November 2013 to July 2014 and included 413 heart failure patients. Eligible patients were randomized to the intervention group and the control group. Patients in the intervention group received comprehensive medication counseling during the hospital stay and on day of discharge and discharge medication orders were reviewed on day of discharge to assess for and correct discrepancies.

Results: Pharmacist interventions during the discharge period reduced 30-day readmission rate by 8.6%. When looking at hospital readmission combined with emergency room visits, there was a 10.1% reduction when comparing the group of patients that was reviewed by a pharmacist versus the group that was not reviewed by a pharmacist. The estimated total cost avoidance from pharmacist involvement during the transition of care was $164.265, with a return on investment of $6.57-54.76 per dollar spent, based on how it is calculated.

Conclusion: Pharmacists can have a significant impact in reducing 30-day readmission rates and emergency room visits for HF patients by being involved in transitions of care.

4-157

Category: Quality Assurance / Medication Safety

Title: Alteplase: quantification and optimization of admixture turn-around-time

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Purpose: Avoidance of delay in the administration of alteplase is an important component of acute ischemic stroke treatment. Quantification and optimization of pharmacy alteplase admixture turn-around-time was identified as a needed aspect of stroke care. This project was designed to quantify and then optimize pharmacy turn-around-time for the admixture of alteplase for ischemic stroke patients.

Methods: Clinical and administrative pharmacists reviewed processes of the utilization of alteplase for ischemic stroke. Specific processes included ordering, admixture, delivery, and internal documentation. After this review, changes were made to each process. Multimodal educational modules were developed to help pharmacists and technicians implement these changes. Written competency tests (one for technicians, one for pharmacists) were administered. A goal of 10 minutes or less between notification of need for alteplase and the drug leaving the department was formulated.

Results: Data collection started in 2011; that year 22 doses of alteplase were admixed and sent for ischemic stroke patients. The median turn-around-time was 8 minutes; mean turn-around-time was 9.8 minutes, with a standard deviation of 3.4 minutes; in 7 cases, turn-around-time was longer than 10 minutes. In 2012, 23 doses of alteplase were admixed and sent. The median turn-around-time was 9 minutes; mean turn-around-time was 8.4 minutes, with a standard deviation of 2.7 minutes; in 2 cases, turn-around-time was longer than 10 minutes. In 2013, 28 doses of alteplase were admixed and sent. The median turn-around-time was 6 minutes; mean turn-around-time was 6.6 minutes, with a standard deviation of 2.0 minutes; in 1 case, turn-around-time was longer than 10 minutes. In 2014, 20 doses of alteplase were admixed and sent. The median turn-around-time was 5 minutes; mean turn-around-time was 5.4 minutes, with a standard deviation of 1.3 minutes; in 0 cases, turn-around-time was longer than 10 minutes.

Conclusion: When supported by multimodal education and competency testing, a process review may be useful in the quantification and optimization of turn-around-time, avoiding delay in administraion of alteplase for patients with ischemic stroke.

4-158

Category: Quality Assurance / Medication Safety

Title: Cold Chain International Regulations in Hamad Medical Corporation (HMC)

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Purpose: Cold chain products (vaccines and other temperature sensitive products) are sensitive biological molecules that lose their potency and effectiveness if they are exposed to temperature outside the required temp range of 2C to 8C during transportation and storage. Failure to adhere to cold chain requirements may reduce cold chain products (vaccines) potency resulting in lack of protection against vaccine preventable disease.

Methods: Creation of HMC-Cold Chain guideline for storing and distribution for vaccines and other temperature-sensitive products comply with the World Health Organization, European Commission, U.S Pharmacopoeia guidelines and the Joint Commission Medication Management Standards. Perform cold chain inspection Training for the receiving section staff. Installation of wireless temperature monitoring system in the warehouse facility. Implementation of HMCs Cold chain guidelines for good distribution practice. Monitoring and updating the guidelines to accommodate any changes in the international practice of cold chain

Results: Availability of well establish cold chain guideline for storing and distribution. Attaining 100% awareness among the receiving section staff. Decreased the wastage of cold chain products during the supply chain process. Increasing the level of confidence among the cold chain Personnel. Automated temperature control data now being received including alerts if the required temperature has been compromised. 80% of cold chain products suppliers complied with HMC- cold chain guidelines.

Conclusion: Compliance with the cold chain guideline will ensure the supply of vaccines of a good quality, appropriate efficacy and high safety profile. Reducing wastage of vaccines will save on costs and ensure stock availability during the immunization programs.

4-159

Category: Transplant / Immunology

Title: Effects of Post Kidney Transplant Vitamin D Therapy on Serum Vitamin D and Parathyroid Hormone Levels.

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Purpose: .This study was conducted to determine if a policy of high dose vitamin D therapy early post-kidney transplantation effects post-transplant 25-dihydroxy-vitamin D (25(OH)D) and intact parathyroid hormone (iPTH) levels.

Methods: .We conducted a retrospective cohort study of 1418 patients that received a kidney transplant between 2008 and 2014. Primary outcomes were to compare pre and post-transplant 25(OH)D (ng/mL) and iPTH levels (pg/mL) in patients either receiving vitamin D therapy, defined as at least one dose of cholecalciferol, ergocalciferol or calcitriol versus no vitamin D therapy during the hospitalization following kidney transplant. Pre-transplant blood levels were collected in the year prior to transplant. Post-transplant blood levels were obtained within a two year follow-up. Secondary outcomes included incidences of graft rejection. Vitamin D therapy was standardized between agents by converting ergocalciferol and cholecalciferol to calcitriol equivalents by a conversion of 50,000units:1microgram.

Results: .There were 1245 patients in the vitamin D group whereas 173 patients went without therapy. The two groups did not differ in regards to age, sex, race, induction or maintenance medications. The mean cumulative dose in the vitamin D group was 3.47micrograms of calcitriol. There was no significant difference in pre-transplant 25(OH)D (27.68 vs. 26.28 p=0.54) or iPTH (312.92 vs. 316.14 p=0.93) levels between the vitamin D and non-vitamin D groups. Similarly, there was no difference in post-transplant 25(OH)D (35.53 vs. 31.30 p=0.06) or iPTH (167.00 vs. 157.09 p=0.70) levels. A linear regression analyses found no association between pre and post-transplant 25(OH)D, iPTH levels, or initial inpatient vitamin D dose. A total of 119 patients experienced graft rejection from any cause, without significant difference between groups (8.2% vs. 9.8% p=0.49). There was no difference in acute cellular rejection (6.0% vs 6.4% p=0.86) or antibody mediated rejection (2.8% vs. 4% p=0.37). However, there was a trend towards less acute cellular rejection with higher doses of vitamin D (7.8% vs. 11.3% p=0.07).

Conclusion: .Pre-transplant 25(OH)D or iPTH levels are not adequate predictors of their respective post-transplant levels. This was regardless of the post-transplant vitamin D dosing

practice at our institution. High dose vitamin D therapy appears to reduce the risk of acute cellular rejection. Further study is warranted to find appropriate dosing protocols that maximize outcomes.

4-160

Category: Transplant / Immunology

Title: One-year incidence of hospital readmission in hematopoietic cell transplant recipients and reasons for readmission

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Purpose: Hematopoietic cell transplantation (HCT) is a potentially curative therapy for patients with certain high risk hematologic diseases. Complications from graft-versus-host disease and immunosuppression result in significant hospital readmission risk for patients following HCT. This study describes the readmission rates, and reasons for readmission, among HCT recipients during the year following HCT.

Methods: The MarketScan Research Databases were used to identify commercial and Medicare enrollees with an ICD-9 or CPT procedure code for an allogeneic or autologous HCT between 7/1/2009 and 6/30/2014. Patients who were discharged alive from the HCT admission and had 365 days of health plan enrollment prior to HCT were retained for analysis; no minimum enrollment was required post-HCT. The first HCT procedure for each patient was defined as the index procedure and was included in the analysis. Hospital readmissions were identified through billing records, and reasons for readmission were categorized based on ICD-9 diagnosis codes for dsDNA virus infection, other opportunistic infections, graft-versus-host disease (GVHD), renal impairment, neutropenia, or other.

Results: The study cohort included 2,926 allogeneic (mean age 47.3 years, 56.8% male) and 4,761 autologous (mean age 53.4 years, 60.0% male) HCT recipients who survived the initial HCT admission. Within one year of transplant, at least one readmission was observed for 1,639 (56.0%; 3,949 total readmissions) allogeneic recipients and for 1,665 (35.0%; 3,250 total readmissions) autologous recipients. Allogeneic recipients had 3,067 readmissions with at least one of the following reasons (77.7% of all readmissions): 593 (15.0%) with dsDNA virus infections, 1,915 (48.5%) with other opportunistic infections, 1,314 (33.3%) with GVHD, 618 (15.7%) with renal impairment and 627 (15.9%) for neutropenia. Autologous recipients had 1,768 readmissions with at least one of the following reasons (54.4% of all readmissions): 99 (3.1%) with dsDNA virus infections, 1,194 (36.7%) with other opportunistic infections, 380 (11.7%) with renal impairment and 625 (19.2%) with neutropenia.

Conclusion: HCT patients are at significant risk for readmission within one year of transplant, with greater risk after allogeneic transplantation. Infections were associated with a significant

proportion of hospital readmissions in both allogeneic and autologous transplant recipients. Optimization of preventive measures against dsDNA viral infections, and opportunistic infections overall, has the potential to reduce the incidence of such readmissions.

4-161

Category: Women's Health

Title: Assessment of gestational diabetes, urinary tract infections, and folic acid intake in Lebanese pregnant females

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Purpose: Pregnancy is associated with multiple health problems, which can be controlled by raising awareness about the complications that occur. Many Lebanese females in their childbearing age are not knowledgeable about the importance of folic acid intake and the risk of developing gestational diabetes mellitus (GDM) or urinary tract infections (UTI) during pregnancy. The aim of this study was to check whether females have been screened for GDM and counseled for UTI and the intake of peri- and postconceptional folic acid.

Methods: The institutional review board approved this retrospective multicenter observational study which was conducted between November 2014 and June 2015 in a community setting. A clinical data collection form was developed and validated. Lebanese females who have experienced at least 1 pregnancy provided an oral informed consent to fill a 10 minutes survey. The pharmD candidates collected data about the participants demographics, educational level, income, age of last pregnancy, number of abortions, past medical history, kilos gained and exercise history during pregnancy. Information regarding the screening for GDM included whether an oral glucose tolerance test (OGTT) and fasting blood glucose (FBG) were performed, along with the medications prescribed. They were also asked whether or not they have taken folic acid at the recommended dose of at least 400 micrograms per day based on the risk factors, before and during pregnancy. As for the previous UTIs occurrence during pregnancy, history and treatment were assessed to check for the appropriateness of counseling in this sense. All statistical analysis was performed using SPSS version 20.0 and presented as frequency, percentage, means, and standard deviations (SD). A pearson chi square p-value of less than 0.05 was considered to indicate statistical significance.

Results: Survey data was analyzed based on 381 females aging 16 to 48 years old (mean: 29.23). The average age of marriage was 21.73, whereas the last pregnancy was achieved at 26.54 years. The females stated that they have conceived around 2.52 pregnancies (mean: 2.18 live children and abortions: 0.36). Only 2 patients (0.5%) had a history of diabetes mellitus, 18.8% gained more than 18 kilos during pregnancy, and 19.9% performed exercise. Concerning GDM, 42.3% stated their knowledge of the importance of such a screening, whereby 59.1% were screened with an OGTT and 32.8% with an FBG. This resulted in having 3.5% positive tests for this type

of diabetes (3.1% had gained <18 kilos; p-value more than 0.05) for which 69% implemented dietary changes and 46% took metformin. As for folic acid intake, 85.6% took it at a dose of 5 milligrams: 33.1% for 1 month before gestation, 46.7% in the first trimester, 27.3% up to the second, and 11.5% throughout pregnancy. It was also noted that all pregnant females were taking folic acid 400 micrograms per day from the vitamin supplement without any assessment of risk factors to adjust the dose.

Conclusion: It was noted that most of the females do not know the role of GDM screening. Moreover, the role of periconceptional intake of folic acid to decrease neural tube defects risk is not sufficiently disseminated to young women, whereas the postconceptional was appropriate, but not based on risk factors. Furthermore, therapeutic management of UTIs in pregnancy requires thorough understanding of antimicrobial agents to optimize maternal and fetal outcomes. Given the considerable risk on maternal and fetal health, pharmacists and prenatal care providers have a key role in enhancing counseling of expecting mothers about GDM, folic acid intake, and UTI management.

4-162

Category: Women's Health

Title: Attitudes of African immigrants in the United States towards birth control

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Purpose: Immigration from Africa to the United States increased more than 750 percent over the past thirty years. The number of African-born US residents grew from 200,000 to more than 1.5 million between 1980 and 2009. As the number continues to grow, so does the pressing need to provide adequate healthcare for these individuals. This study was designed to determine beliefs and attitudes towards contraceptive methods with a focus on ethnic and gender differences in US immigrants of African descent.

Methods: This was a descriptive study to understand attitudes of African immigrants towards contraceptive use while exploring demographics, US acculturation, and sexual behavior. The Contraceptive Attitude Scale (CAS) was utilized; low CAS scores indicated negative attitudes while high CAS scores indicated positive attitudes. An online survey was developed and distributed electronically to immigrant adults via electronic mail and social media. The contraceptive methods evaluated were the male condoms, oral contraceptive pills, intrauterine devices, birth control patches, vaginal rings, hormone injections, abstinence, withdrawal method and emergency contraception. Factors considered included age, time since immigration, education level, marital status, religion, whether participants were of African descent and whether they were first, second or third generation American.

Results: Most African immigrants had a positive attitude regarding contraception. There was no significant difference between the first, second and third generation Americans with a CAS score of 101, 102 and 103 respectively. The participants 44 years and older had the lowest CAS scores (72 out of 128), while participants 34 to 44 years old had the highest CAS scores (102 out of 128). Female immigrants had higher CAS scores (105.5 out of 128) than male immigrants (98.5 out of 128). The most popular contraceptive method was the male condom, as 62 percent of participants indicated they were likely to use it, while the least popular method was the hormone injection, as only 0.06 percent of participants indicated they were likely to use it.

Conclusion: Younger, female African immigrants were most likely to have positive attitudes towards contraceptives, while older, male African immigrants were most likely to have negative attitudes. With these findings, healthcare professionals can develop more efficient strategies and programs specifically to educate the African immigrant population on effective and safe contraceptive methods. Clinicians may use the available data to improve contraceptive information resources to address the concerns and possibly bridge existing knowledge gaps in

the African immigrant community. Pharmacists may also use this information to provide more efficient counseling for their African immigrant patients.

4-163

Category: Women's Health

Title: Implementation of an obstetric pharmacist

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Purpose: This report describes the results after an obstetric (OB) pharmacist was implemented. The obstetric unit is often overlooked by the pharmacy when determining where resources should be utilized. The development of the OB pharmacist was designed to give nursing management, physicians, and ancillary staff a point of contact in the pharmacy for implementation of medication related processes and pharmacy concerns. The obstetric pharmacist was also developed to be a liaison for pharmacy management and personnel to relay nursing medication-related concerns.

Methods: The institution is a 616 bed, Level 1 trauma center. The Family Birthing Center consists of a Level III Administrative Perinatal Center serving 24 counties, twenty-three antepartum beds, eight Labor and Delivery suites, 2 C-Section suites, and 29 postpartum beds. Training of the OB pharmacist was the first step in implementation. An intensive 27 credit hour course titled, Diseases, Complications, and Drug Therapy in Obstetrics through Washington State University College of Pharmacy was chosen to infer competency. Next, a Maternal Fetal Medicine physician leader dedicated to medication and patient safety was identified for the pharmacist and nursing administration to work with. A monthly meeting with the physician, OB pharmacist, informatics pharmacist, nursing management, and nursing educators was established to discuss medication-related concerns. These meetings provided an opportunity to review computerized physician order entry, current guidelines, order set management, medication errors, and medication-related patient safety issues. Another responsibility of the OB pharmacist was to attend the monthly Family Birthing Center Unit Council. Nursing management, educators, bedside nurses, and lactation consultants comprise the unit council. This meeting provided a multidisciniplary approach to promote teamwork in analyzing

Results: From July 2013 through June 2015, several medication-related concerns were identified and addressed. Outcomes of the monthly multidisciplinary meeting included: Implementing a more streamlined approach for culture review in OB triage; Nursing, physician and resident education on lidocaine dosing for episiotomy repair and neonatal circumcision; Critical range blood pressure monitoring, treatment and standardization; Intrapratum insulin order set design and implementation; Monthly obstetric newsletter for physicians and nursing. Meeting with the Anesthesia department also provided positive results. It was concluded sodium bicarbonate would no longer be used at the bedside to buffer lidocaine due to the 50ml single dose vial being used more than once. It was also concluded a medication tray with anesthesia specific

medications needed to be in each C-section room incase of Pyxis downtime. Additional medications were also removed from the OB epidural cart due to low volume of use. Likewise, the par level of certain medications in the epidural cart was increased due to increased use.

Conclusion: Implementing a pharmacist dedicated to the obstetric unit was beneficial in identifying many medication-related concerns. In addition, nursing management, resident and attending physicians, support staff, and pharmacy personnel have expressed increased satisfaction in having a pharmacy liaison to relay concerns and help identify opportunities for improvement.

4-164

Category: Oncology

Title: Pegfilgrastim on-body injector performance as studied with placebo buffer in healthy volunteers

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Purpose: Pegfilgrastim is not indicated for administration between 14 days before and 24 hours after cytotoxic chemotherapy. Patients must therefore return to the clinic to receive a pegfilgrastim injection. We developed a single-use, disposable, battery-powered on-body injector that is activated and attached to the patient's skin with an adhesive backing at the clinic on the same day as chemotherapy. The injector is designed to automatically deliver a single subcutaneous dose of 6 mg pegfilgrastim over approximately 45 minutes, beginning 27 hours after activation. In this study, we assessed the performance of the injector delivering drug-mimic placebo buffer in healthy volunteers.

Methods: In this open-label study, healthy men and women volunteers aged 18-55 years, with a body mass index of 18-35 kg/m2, each received 2 concurrent placements of injectors: one on the abdomen and one on the back of the upper arm. To activate the injectors, site staff filled them with placebo using a prefilled syringe; each syringe contained 0.64 mL to enable delivery of 0.6 mL with the injector. The primary endpoint of the study was successful delivery of placebo based on a composite of the following: no substantial leakage during or after the injection, green status light indicator on the injector during and after the injection, and fill indicator bar at the empty position after the injection. The secondary endpoint of the study was the incidence of treatment-emergent adverse events. The institutional review board approved this study and all volunteers provided informed consent.

Results: Of the 150 volunteers enrolled, 149 (99.3%) completed the study. Demographic distribution of study volunteers was as follows: 72 (48.0%) men, 78 (52.0%) women; mean (range) age, 36 (18-55) years; ethnicity/race, 47.3% white, 35.3% black or African-American, 12.7% Asian, 4.7% other. A total of 292/297 (98.3%) deliveries were considered successful: 147/149 (98.7%, 95% confidence interval [CI; 95.2%-99.6%]) to the abdomen and 145/148 (98.0%, 95% CI [94.2%-99.3%]) to the back of the upper arm. A solid green indicator light indicating a completed injection was observed in 295/297 (99.3%) of the injections, and the fill indicator bar was at the empty position in 297/297 (100.0%) of the injections. Three events of substantial leakage, as defined by observance of either a saturated adhesive pad or visible dripping of fluid, were reported among 3 volunteers. All 150 volunteers were included in the

safety analysis; 51 (34.0%) reported at least 1 adverse event during the study. No serious adverse events were reported. The most common treatment-emergent adverse events were injector-site reaction in 31 (20.7%) volunteers, catheter-site hemorrhage in 13 (8.7%) volunteers, and headache in 5 (3.3%) volunteers.

Conclusion: The pegfilgrastim on-body injector successfully delivered placebo to the abdomen or the back of the upper arm 98.3% of the time, as indicated by the composite of no substantial leakage during or after the injection, green status light indicator on the injector during and after the injection, and fill indicator bar at the empty position after the injection. The on-body injector was well tolerated and may allow patients to receive pegfilgrastim as indicated, approximately 24 hours after chemotherapy, without the need to return to the clinic for an injection.

6-001

Category: Administrative practice / Financial Management / Human Resources

Title: Economic impact of a pharmacy council on drug cost containment goals

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Purpose: Creating a systematic approach to evaluate and implement drug cost containment goals in a healthcare consortium by forming a Pharmacy Council. The healthcare consortium coordinates business meetings between the member health systems, the consortium, the GPO and the Wholesaler. By forming councils specific to the various departments of the hospital, the consortium is able to pursue initiatives that are evaluated by and advantageous to the members. The result has been initiatives that are beneficial to all the member hospitals, enhanced communication between all parties and transparent identification of any obstacles to pursuit of the pharmacy initiatives.

Methods: The Pharmacy Council consists of Directors of Pharmacy from the member hospitals, Pharmacy Buyers, Consortium staff, a representative from the GPO, and representatives from the Wholesaler. Cost containment opportunities are presented to the Pharmacy Council by the GPO and Wholesaler representatives at regularly scheduled meetings and conference calls. The GPO and Wholesaler each housed vital information needed by the Directors to make informed decisions and are vital players in the drug cost containment success. The Pharmacy Council discusses the opportunity identifies any challenges, discusses drug availability and vendor performance, evaluates the financial impact and decides which initiatives to pursue. . Once the initiative is accepted, each is tracked and reported on a quarterly basis back to the council. The data is displayed by group performance and by individual hospital performance. The Pharmacy Council is able to determine how an initiative is trending in the first quarter after implementation. Members, of the consortium, not performing well in the initiative are identified and opportunities for improvement reviewed. Best practices are discussed and members are able to network regarding any progress or challenges in their individual hospitals.

Results: By creating the Pharmacy Council and bringing all the vested players into face to face meetings and regularly scheduled conference calls, substantial improvements have been realized in efficiency and exceeding drug cost containment goals. Over the past five years, the Pharmacy Council has documented $ 10 million in drug cost containment achievements. Initiatives have included market share contracts, therapeutic interchanges, restrictions, institutional size packaging, and brand to generic conversions and class monitoring. In addition, new drugs to market are monitored, until a trend can be identified, to determine any significant cost increase for each hospital. Examples of the successful initiatives have been 5HT3, Hematopoietics,

GPiib/iii, Anesthesia Gases, Anticoagulants, Lymphazurin as opposed to Methylene Blue, Carbapenems, and Advair strengths and package sizes. Additional monitoring has included oral anticoagulants, Neupogen and Neulasta, REMS goals and the additional expenses incurred. The Wholesaler Generics program is utilized to assist the member hospitals in obtaining even greater savings. The program has evolved and become more complex, with several member hospitals becoming 340B eligible. Each initiative is now tracked in 3 different areas, non-340B, 340B and WAC purchases to determine the cause and effect on initiative performance. Total drug cost containment acknowledges economic considerations such as absolute reduction, cost avoidance and drug spend attenuation.

Conclusion: The Pharmacy Council has successfully coordinated, implemented and quantified supply chain initiatives that accomplished pharmacy department drug cost containment goals, increased efficiency, encouraged member hospital accountability and formed a working partnership between the hospitals, the GPO and the Wholesaler. Pharmacy Council members are able to network, discuss best practices, identify obstacles and select initiatives that are well suited for their hospital. It is recommended that other groups and systems explore the benefits of forming a Pharmacy Council.

6-002

Category: Administrative practice / Financial Management / Human Resources

Title: Implementation of a nontraditional pharmacy residency at a 583 bed, non-profit, community teaching hospital

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Purpose: Several areas identified for improvement for our institution from the Pharmacy Practice Model Initiative completed at our hospital in 2013 were an insufficient number of staff persons (hindering the development of an optimal pharmacy practice), need for recognition of pharmacists by other staff as leaders in drug therapy management, and less than 50% of staff pharmacists having completed an ASHP-accredited pharmacy residency. A solution was proposed to start an ASHP-accredited nontraditional postgraduate year one pharmacy residency (NTR) to increase training of current staff and ultimately provide a higher level of care to our patients.

Methods: A literature review related to NTRs was conducted, and the residency program director contacted program directors of several active NTRs to discuss their differing structures, benefits and requirements. Next, an email was sent out to the current pharmacists at our hospital describing the concept of a NTR program and encouraging staff to respond with any level of interest. A proposal was submitted to hospital administrators for approval of an additional post-graduate year one resident. Once the position was approved, detailed information about the program was emailed to all inpatient pharmacists. The program was briefly discussed at routine staff meetings regarding when and where a follow-up meeting would take place. The follow-up meeting agenda included information about the learning experiences, meetings and requirements for successful completion of the program. Additional information was also provided about PhORCAS, the resident matching system, how a curriculum vitae differs from a resume and additional resources. The nontraditional applicants were required to complete the same interview as the traditional candidates, with the exception that they did not receive a tour and were notified in advance that candidates would not be made known to those outside of the interview committee.

Results: Two nontraditional residents will be incorporated into the program over two years in a staggered, cyclical approach with one resident hired and graduating each year. Residents will alternate six weeks of residency with six weeks of staffing based upon our current staffing model, which is based on every third week rotations. The nontraditional resident will have the same required learning experiences as the traditional residents. Additional application requirements include a 0.5 full time employee status as an inpatient pharmacist for 12 months prior to the first day of residency. The stipend will be a salary that is the midpoint between current (pre-resident pharmacist) salary and our traditional resident salary. Upon successful

completion of the NTR, the pharmacist will retain their FTE status prior to the NTR. Eight responses were received to the initial email, which was deemed enough interest to move forward with a formal proposal. Since pass thorough funding is not available for NTRs, the pharmacy department gained approval for the NTR and incorporated the positions into the standard pharmacy staff budget. Our institution had two applicants and was able to match with a pharmacist who will be the first to complete a NTR at our hospital.

Conclusion: The first nontraditional pharmacy resident will start in the summer of 2015 and continue through summer 2017. Applications will be accepted again for a resident to start in 2016-2018, resulting in a nontraditional year-1 resident and nontraditional year-2 resident each year. We anticipate the nontraditional residency program will enhance leadership skills and provide advanced clinical pharmacy training that will ultimately benefit our patients.

6-003

Category: Administrative practice / Financial Management / Human Resources

Title: University Pharmacy Resident Services, Inc.: a novel approach to employment of pharmacy residents

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Purpose: Despite increased demand for pharmacy residencies, the number of residency programs and positions are often limited by cost. Aside from resident salary, other expenses such as benefits, accreditation costs, and travel stipends may make expansion and/or addition of programs cost-prohibitive. The University at Buffalo School of Pharmacy and Pharmaceutical Sciences (UB SPPS) maintains a residency training program with six PGY1 and two PGY2 residencies. University Pharmacy Resident Services, Inc. (UPRS) is a corporation separate from UB SPPS that was created with the purpose of reducing residency program costs, standardizing benefits and reducing liability associated with residents rotating across practice sites.

Methods: UPRS was incorporated in June 2014 and began employing residents July 1, 2014. The sites at which each resident practices provide funding for the residents via UPRS. UPRS serves as the employer of record for the resident(s) matched to their site, while the Residency Advisory Committees (RACs) at UB SPPS and the individual practice sites maintain control over all educational aspects of the programs (e.g. program structure, adherence to accreditation standards, resident scheduling, etc.). The corporation provides a health benefit plan to each resident, administers paid time off, and provides workers compensation and disability insurance. Residents are required to purchase and show proof of their own professional liability insurance. The corporation carries both general liability and directors and officers liability insurance.

Results: UPRS employed two residents during the 2014-2015 residency year. Not including resident salary, travel stipend or incidentals, costs decreased by $3,132.30 and $4201.43 since moving these residents to employment under UPRS. These costs are expected to decrease further as the number of UPRS-employed residents increases because general costs to the corporation (e.g. workers compensation, general liability insurance, directors and officers liability insurance, etc.) are shared among participating residents. The passing of funds through the corporation, as opposed to the university, eliminated the 13% fee paid on all deposits from the residency sites to the university, yielding an additional cost savings of over $17,000 between the two programs.

Conclusion: The formation of a stand-alone corporation for employing pharmacy residents reduced program costs and standardized the benefits between residency programs during its first year in existence. Further cost savings are expected as more residency programs participate in the corporation.

6-004

Category: Administrative practice / Financial Management / Human Resources

Title: Indirect expenses related to clinical services in the clinical staffing practice model

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Purpose: Demonstrating the value of clinical pharmacy services has become paramount in the changing practice model of the staff pharmacist. Over the past two years, our pharmacists have become more involved in direct patient care with specific drug monitoring, multidisciplinary team participation, and responsibilities related to quality and outcomes measures. Unfortunately, providing these services is something that the pharmacy is not being reimbursed for at this time. This project attempts to quantify and describe not only the types of clinical services provided, but the time and cost related to clinical initiatives lead by clinical staff pharmacists.

Methods: Since the implementation of several direct patient care initiates by staff pharmacists, the time devoted to these tasks was documented by pharmacists using the workload function in the Siemens Pharmacy software system. A categorical description of the type of patient care, intervention, or education was provided along with total duration of time required to complete each task. The time documented for each task was left to the pharmacists discretion. The time commitment for these services was then totaled by month and adjusted to be expressed in full-time employee equivalents.

Results: Clinical services provided by clinical staff pharmacists include clozapine monitoring, intravenous-to-oral medication interchanges, renal monitoring, vancomycin and aminoglycoside dosing and monitoring, warfarin monitoring, multidisciplinary patient care rounds, venous thromboembolism monitoring, and code blue response. Since documentation of workload began in January 2013, there has been a significant increase in time devoted to these clinical initiatives. The number of clinical initiatives the pharmacists are responsible for has also increased over the past two years. As of April 2015, this time requirement is approaching one full-time employee equivalent per month.

Conclusion: Documentation of this time commitment is just one way to measure the value of clinical services provided by clinical staff pharmacists. Keeping this information going forward will allow pharmacy administrators to provide cost evidence of our dedication to the best patient-centered care possible.

6-005

Category: Administrative practice / Financial Management / Human Resources

Title: Value-based formulary design across a health system

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Purpose: This project describes a formulary standardization process across a multi-hospital health system, and the utilization of a value-based decision matrix to assist with that. Historically, the management of our hospital formulary has been through gathering of data to create a drug monograph which is then presented to the Pharmacy and Therapeutics Committee for approval or disapproval. Though the information prepared is thorough, it often becomes difficult to quantify the value of this decision to the health system. The purpose of this project is to describe an innovative value-based decision matrix for medication formulary decisions.

Methods: The St. Lukes Health System is composed of seven hospitals across Idaho, and the System Formulary Workgroup (SFW) is the system entity in charge of making formulary recommendations to the local P&T Committees at each hospital location. In 2013, SFW was charged with reviewing all drug classes to make evidence-based recommendations for formulary inclusion and exclusion to help achieve the overall health system goals of better health, better care, and lower cost. The SFW guidelines for formulary class reviews were to 1) start with quality, 2) maximize safety, 3) consider usage, and 4) end with costs. Pharmacists from across the health system were recruited to assist with class reviews. Each drug entity within a class was voted on by SFW to be one of the following categories: formulary, formulary non-stocked, restricted, and non-formulary. During the formulary review process, a need was recognized to better quantify medication differences within a class to come up with solid recommendations, particularly when streamlining medications. A value analysis was then developed by assigning points for each of the review guidelines (quality-5 points, safety-4 points, inpatient/outpatient usage-2 points, and costs-3 points).

Results: Over 30 St. Lukes pharmacists participated in the medication class reviews. During the span of 14 months, all therapeutic classes were reviewed and standardized across the health system. For 1505 individual drug entities that had previously been on formulary, 1036 were continued on formulary, 40 became formulary non-stocked, 49 were restricted to a particular service, and 380 drugs were removed from the formulary. The value analysis scoring matrix was developed midway through the formulary class review process and assisted in making recommendations for drug classes. For example, within the statin class, each drug was rated for quality, safety, usage and cost. The highest value drug, atorvastatin (score of 13), was determined to be the preferred statin. Pravastatin ranked second (score of 11) and became the alternative statin for the health system. All other statins were then removed from the formulary with therapeutic substitutions to one of the preferred statins. This methodology was applied to

other therapeutic classes such as Alzheimers medications, Parkinsons medications, stimulants, etc., to make evidence-based value decisions for the health system.

Conclusion: Managing medication formularies has long been a core function of hospital pharmacies and health systems. Many industries use a value analysis to develop and select products. A value-based formulary is an idea whose time is here, and this report explains an example of how this can be done within a health system. This project may provide a framework for both reviewing therapeutic classes and reviewing a new drug compared to others in the same class. The impact to the St. Lukes network has been a strengthened evidence-based formulary review process that may be applied to other health care entities.

6-006

Category: Administrative practice / Financial Management / Human Resources

Title: Building and Remodeling your pharmacy: How to do it !

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Purpose: Baystate Medical Center (BMC) is a 720-bed tertiary care, level 1 trauma center and teaching institution. Over time the demand for pharmacy services has grown exponentially and we have quickly outgrown our aging pharmacy space. Space constraints have limited our ability to implement the latest in automated work flow technology. In collaboration with senior leaders, our team performed a needs assessment of pharmacy services and granted the opportunity to relocate the acute care pharmacy. Our goal was to design a state of the art pharmacy that would meet all regulatory requirements and encompass operational best practices.

Methods: The Pharmacy Leadership Team began the process of engaging front-line technicians, pharmacists, purchasers and support staff to participate in a Pharmacy Facilities Planning Team (PFPT) to establish baseline workflows and metrics, working timelines and create ideal future-state workflows. The group developed a charter that included core team members, expectations and guiding principles. This charter was instrumental in keeping the momentum and focus of the planning committee. The PFPT met bi-weekly to identify risks, vetted workflows, discussed progress, and supported the decision-making for new equipment and configurations of the designed space. A steering committee was developed to support decision making and help guide the PFPT committee. This multidisciplinary group included pharmacy leadership team members, architects, information technology analysts and process improvement representatives. During the initial design phase our planning committee team members in collaboration with architects performed numerous site visits within hospitals that we identified as having best practices or that utilized the technology that we were considering.

Results: Relationship building between architects, pharmacy team members including pharmacists and technicians, hospital facilities team members, IT, security, distribution, hospital leadership, and vendors was crucial to our success. As a result our team created a state of the art pharmacy design, meeting all state and federal pharmacy requirements. The new pharmacy will be fully compliant with USP 797, 795, and 800 with dedicated areas for each type of compounding. Ideal and meaningful future state workflows were created to maximize the pharmacy service to our external customers, assess resource needs, and integrate new technology and workflows. In collaboration with our IT partners, we were able to develop necessary interfaces between our carousel, automated dispensing machines, and electronic medical record to allow for optimal medication dispensing. The PFPT included more than 25 percent of our staff

and included a wide cross section of all pharmacy positions. During this process the pharmacy realized increased employee engagement scores and staff satisfaction.

Conclusion: During the next few months our team will complete the cutover to our new pharmacy and will work to transition our patient care services with redesigned workflows, implement new technologies, while maintaining regulatory compliance. Through this project new leaders emerged, barriers were removed, and collaboration was maximized. In addition we solidified and forged relationships with key hospital leaders that reinforced the invaluable role pharmacy contributes to optimal patient care.

6-007

Category: Ambulatory Care

Title: Pharmacists role in multidisciplinary pain management programs

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Purpose: The baseline knowledge provided in pharmacy and medical schools cannot truly prepare students and residents for the nuances of managing patients with chronic pain. This poster describes the unique pain management programs at two family medicine residencies in Wyoming and Colorado and how pharmacists are utilized. Both programs involve the use of interdisciplinary teams; one to facilitate the surveillance of controlled substance prescribing within the clinic, the other to provide care in a pain clinic environment. These programs were started due to increased patient demand of chronic pain medications, resident clinical experience imbalances, and to improve quality of care.

Methods: Improving pain management was a clinic wide discussion for both programs as they achieved level 3 PCMH recognition. These family medicine residencies have incorporated the pain management programs into their curriculums and patient visits. There are both the practical hands on approach of seeing patients in clinic and didactic lectures covering a variety of pain management topics including prescribing narcotics, addiction/dependence issues, DEA regulations and alternative methods of treatment. All residents and students participate in-group visits and individual patient appointments for care management. Pharmacy students and residents perform medication reconciliation and assist nursing with obtaining vital signs. Various scheduling templates are incorporated into these visits to allow for adequate time for patient care. One program now has a dedicated chronic pain phone number so that a constant care team handles patient care.

Results: Forty-three medical residents, 2 pharmacy residents and numerous pharmacy students are exposed to these programs during a single academic year. Since the inception of these programs, we have seen decreased clinic complaints from patients and providers, increased community volunteerism from patients who are more functional, an increase in medical residents interests in learning about pain management, and compliance with the use of pain contracts. Both programs have one outpatient pharmacist who handles the pharmacy aspects of the pain management program; including recommending dosing regimens, screening for drug interactions, ordering laboratory values, surveying prescribing databases and participating in teaching providers and patients. Medical residents are able to see first hand how to calculate equivalent doses and follow state and federal regulations and formularies. Pharmacy students and residents participate in all aspects of care and see true interprofessional collaboration first hand. Patients have gained an understanding of the role of the pharmacist in the health care team.

Conclusion: Providing patients with quality pain management can be a difficult task, since this is often not an area of expertise. In the past 4 years, we have incorporated group visits, pain contracts, patient education, care management, care coordination, and long- and short-term functional goal setting into caring for chronic pain patients. Highlighting these concepts in both pharmacy and medical student and resident education is an important part of each program's curriculum. The utilization of these novel programs to enhance care for chronic pain patients in designated patient centered medical homes has enabled the much-needed standardization for a challenging disease state.

6-008

Category: Ambulatory Care

Title: Evaluating the clinical use of the 2013 ACC/AHA cholesterol guidelines vs ATPIII cholesterol guidelines in HIV positive and HIV negative patients.

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Purpose: There are differences between the ACC/AHA 2013 guidelines and the Adult Treatment Panel III (ATP III) guidelines including different cardiovascular risk reduction calculators and different paradigms for treating dyslipidemia. The differences in these guidelines may be significant including the percent increase in cardiovascular risk when comparing the calculators, their recognition for treatment goals, and preferred therapy options. The purpose of this project is to identify the practical differences in the implementation of the two guidelines and to identify differences in recommendations for statin use for HIV positive and HIV negative patients. Pharmacists recommendations for statin use were also examined.

Methods: This project was approved by the University of Louisiana at Monroe IRB and endorsed by Our Lady of the Lake Regional Medical Center (OLOLRMC). Research was performed by analyzing information from a retrospective chart review of patients who saw their primary care provider at the Louisiana State University MidCity Clinic: A Division of OLOLRMC and held a diagnosis or were diagnosed with dyslipidemia between December 1st, 2013 and October 1st, 2014. Patients were excluded from the study if they were <18 years of age and/or pregnant/lactating. The following data was collected: sex, age, race, family history for cardiovascular disease, smoking status, diabetes status, blood pressure medication use, blood pressure, and most recent lipid panel. Pharmacists retrospectively evaluated each patients lipid profile using both guidelines (ACC/AHA 2013 and ATPIII) to determine practical differences in the implementation of each. Pharmacists also documented whether statin therapy was initiated for patients during each historical patient visit, and whether the pharmacist recommend a statin to the provider. If recommendations concerning patients dyslipidemia were given to the physician, pharmacists documented if the recommendations were accepted or rejected.

Results: A total of 191 patients were reviewed and of those 30.4% where on statin therapy at baseline. There were 94 HIV(+) patients and 97 HIV(-) patients. The ACC/AHA guidelines could not be applied to 15% of the patients. When using the ACC/AHA guidelines, statins were indicated in 65.3% of HIV(+) patients versus 48.3% of HIV(-) patients. Statins were indicated in 57.9% of patients (ACC/AHA) versus 26.3% of patients (ATPIII) who were not on therapy at baseline. In the same patients, the average ACC/AHA risk scores were 25.9 vs 9.1 for Framingham. High-to-moderate intensity statins were indicated more often in HIV(+) patients compared to HIV(-) patients. When comparing the two guidelines, high-to-moderate intensity

statins were indicated in 57.2% of patients per ACC/AHA guidelines and 18.7% of patients per ATPIII. Pharmacists recommended statin therapy in 42.9% of all patients and, for patients not already on statin therapy, pharmacists recommended to initiating therapy in 46.6% patients. Predictors of pharmacists recommending therapy initiation include total cholesterol (p=0.0005), LDL-C (p=0.0125), triglycerides (p=<0.0001), and the risk scores (p=<0.001). Providers accepted 48.4% of pharmacists recommendations. Predictors of provider acceptance of pharmacists recommendations include LDL-C (p=0.437).

Conclusion: Statin therapy was recommended more often for HIV(+) patients compared to HIV(-) patients. The implications of cardiovascular risk in HIV(+) patients needs to be further explored. The ACC/AHA risk calculator indicates more statin use compared to Framingham and this means that more patients may be initiated on high-moderate intensity statins. This raises concern for increasing the need to better monitor effectiveness and adverse events. Provider acceptance was less than expected and may be attributed to the study occurring shortly after the AHA/ACC guidelines were released. Better education of the ACC/AHA guidelines is needed for providers to gain acceptance of recommendations.

6-009

Category: Ambulatory Care

Title: Pharmacist interventions related to hypertension in a primary care clinic

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Purpose: Hypertension is a major risk factor for cardiovascular disease and stroke. Recent statistics indicate that the prevalence of hypertension among adults in the United States is approximately 33%, or an estimated 80 million people. Though the percentage of patients with controlled hypertension has increased from 48% in 2009 to 53% in 2010, there remain a large number of patients with uncontrolled hypertension. Studies have shown that pharmacists, as part of an interdisciplinary team, can positively impact blood pressure control. This report describes interventions related to hypertension made by a pharmacist practicing within a primary care clinic setting.

Methods: Pharmacist interventions were documented prospectively for a 6-month period between January 1, 2014 and June 30, 2014. Interventions were made during a clinic visit with the pharmacist, or via telephone, and included medication adjustments (initiation, discontinuation, dose increase or decrease), identification of drug-drug/drug-disease interactions, adherence issues, lab abnormalities, adverse effects, medication errors, medication contraindications as well as cost savings opportunities.

Results: A total of 58 patients were seen, as new referrals, for hypertension during the specified time period. At year's end, 66% of the newly referred patients were considered controlled per the vitals documented in the electronic medical record compared to 57% for the primary care department overall. The percentage of controlled patients in the pharmacist group increased to 88% when home blood pressure readings were taken into consideration; those readings were only considered if the home blood pressure device used was correlated in the clinic setting. In total, there were 52 medication adjustments made prior to patients reaching blood pressure goal; 24 were made by the referring provider, 28 were made by the pharmacist. Regarding safety, there were 22 medication safety issues identified, 11 of which were considered to be, or have the potential to be, of moderate or high clinical significance.

Conclusion: This descriptive report supports that a pharmacist, as part of an interdisciplinary primary care team, can improve blood pressure control as well as identify clinically significant safety issues related to medication management. This report also highlights the importance of home blood pressure readings in the assessment of blood pressure control. This may be something for health plans to consider in the future when evaluating performance measures. Currently, the Healthcare Effectiveness Data and Information Set (HEDIS) tool does not recognize home readings for the blood pressure control measure.

6-010

Category: Ambulatory Care

Title: Evaluation of sustained virologic response rates after hepatitis C virus treatment at an urban academic medical center

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Purpose: Treatment options for hepatitis C virus (HCV) have evolved immensely over the last five years. New direct acting antiviral agents offer improved sustained virologic response (SVR) rates, denoted by an undetectable HCV viral load 12 or 24 weeks after treatment completion. However, differences among baseline patient characteristics, tolerability, and adherence often yield different real-world SVR rates than clinical trial results. The purpose of this study is to evaluate the SVR rates among the HCV regimens used at an urban, academic medical center over the last 5 years. The secondary outcomes are to evaluate SVR rates based on baseline patient characteristics.

Methods: This retrospective chart review was approved by the institutional review board. Investigators reviewed the electronic medical records of patients who began HCV treatment under the care of a clinical pharmacist at the liver clinic from June 1, 2009 to December 9, 2014. Investigators collected baseline characteristics, including age, gender, ethnicity, body mass index (BMI), stage of liver disease, concurrent medications, comorbidities; previous HCV treatment history; current HCV regimen and dosage; lab results pertaining to disease progression and medication use; and any interruption, discontinuation, or modification of HCV treatment. In addition, adverse events, adherence, hospitalization, and infection rates were assessed. The data were analyzed using descriptive statistics, Fishers exact test, and Pearsons chi-square test. The primary endpoint was the number of patients that reached SVR24 or SVR12 in each of the seven treatment groups utilized over the 5 years: pegylated interferon monotherapy, pegylated interferon and ribavirin, telaprevir or boceprevir plus pegylated interferon and ribavirin, sofosbuvir plus pegylated interferon and ribavirin, sofosbuvir and ribavirin, sofosbuvir and simeprevir, and ledipasvir/sofosbuvir.

Results: Three hundred ninety patient treatment courses were included in the study. The population was 59% male, 44% African American, had a mean age of 56 years, and a baseline BMI of 30. In addition, 83% had genotype (GT) 1, 39% were treatment experienced, 47% were cirrhotic, 33% had baseline psychiatric disease, 26% had diabetes, and 16% were post-transplant. Overall, non-cirrhotic, and cirrhotic SVR24 rates were 20%, 25%, and 0% in 5 patients on pegylated interferon; 30%, 32% and 26% in 104 patients on pegylated interferon and ribavirin; and 56%, 57% and 56% in 78 patients on telaprevir or boceprevir plus pegylated interferon and

ribavirin. Overall, non-cirrhotic, and cirrhotic SVR12 rates were 80%, 75% and 83% in 10 patients on sofosbuvir plus pegylated interferon and ribavirin; 65%, 79% and 50% in 55 patients on sofosbuvir and ribavirin; 80%, 88% and 74% in 110 patients on simeprevir and sofosbuvir; and 75%, 77% and 73% in 28 patients on ledipasvir/sofosbuvir. Patients with GT2 and GT3 had SVR24 rates of 59% and 54% with pegylated interferon and ribavirin; SVR12 rates were 79% and 67% with sofosbuvir and ribavirin, respectively. Twelve percent of patients were hospitalized, 9% had infections, and no patients died during treatment.

Conclusion: Sustained virologic response rates at the urban, academic medical center were lower than SVR rates reported in clinical trials. Our patient population included a high percentage of both historically and currently difficult-to-treat patients; including cirrhotic, African American, treatment experienced, and post-transplant patients, and patients with baseline psychiatric disease. Future directions include comparisons to other real world data with larger patient populations, and further study of the patients currently on all oral direct-acting antiviral treatment regimens.

6-011

Category: Ambulatory Care

Title: Reducing high risk medication prescribing trends in senior patient population within the ambulatory care setting

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Purpose: Medication side effects are a serious patient safety concern in the senior patient population which can lead to falls, accidents, and poor patient outcomes. High risk medication prescribing in the senior patient population was identified as an area of opportunity to improve patient safety, reduce the incidence of medication adverse events, and facilitate compliance with Center for Medicaid and Medicare (CMS) patient quality outcomes. This project was implemented to impact high risk medication prescribing practices within the ambulatory care setting through the use of the electronic medical record (Ambulatory EPIC platform).

Methods: An interdisciplinary team developed strategies to reduce prescribing patterns of Beer's List and Centers for Medicaid and Medicare (CMS) identified high risk medications in the senior patient population. Twenty-three commonly prescribed high risk medications were identified by reviewing prescribing trends within the medical group. As part of this initiative, the interdisciplinary team developed synchronous electronic best practice advisories (BPA) that display when one of the identified medications is ordered within urgent care and medical office practices. The BPA notifies the prescriber that the ordered medication is considered high risk in patients greater than 65 years of age, advises the prescriber of the associated medication side effects, and recommends cost-effective and safe alternative therapy. In addition, the BPA allows the prescriber to document comments regarding the alert and includes an option for the prescriber to acknowledge that the patient understands the risk associated with medication use.

Results: From April 9, 2015 until May 31, 2015, the BPA was triggered during the medication order entry process 3109 times within the medical group including urgent care and medical office practices. This impacted 2423 patients with an average of 1.28 alerts per patient. The ordered high risk medications included zolpidem (n=671), cyclobenzaprine (n=486), meclizine (n=333), promethazine (n=248), diazepam (n=239), hydroxyzine (n=165), amitriptyline (n=148), indomethacin (n=101), oral estrogens (n=100), dicyclomine (n=93), methocarbamol (n=80), eszopiclone (n=70), diphenhydramine (n=60), amphetamine/dextroamphetamine products (n=57), barbiturates/butalbital products (n=56), megestrol (n=41), carisoprodol (n=37), scopolamine (n=37), hyoscyamine (n=31), doxepin (n=22), zaleplon (n=13), chlorzoxazone (n=13), and cyproheptadine (n=8). In 28% of the BPA alerts, providers documented that the

patient understood the risk associated with the prescribed high risk medication. There were 163 patients that were prescribed more than one of the identified high risk medications. Of these 163 patients, 21.4% had the prescribed high risk medication discontinued due to the triggered BPA.

Conclusion: The BPA provides real-time education to prescribers regarding the potential negative outcomes associated with high risk medications in the senior patient population and guidance regarding safer alternative therapies. Longitudinal data collection is needed to show the overall impact of the BPA on high risk medication prescribing trends within the medical group.

6-012

Category: Ambulatory Care

Title: Impact of clinical pharmacists in Hepatitis C Virus (HCV) outpatient clinic

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Purpose: Historically, Hepatitis C virus (HCV) infection has been difficult to treat due to intolerance to treatment and poor response rates, particularly in special populations such as solid organ transplant. However, the recent influx of new direct-acting antiviral agents (DAAs) offers promising options for HCV-infected patients, including special populations. Utilization of DAAs necessitates consideration of appropriate regimens, adverse effect profiles, potential for drug interactions, and cost implications. Pharmacists are in an ideal position to assist with these endeavors. Our objective is to identify and describe the impact of clinical pharmacist involvement in HCV treatment, specifically with the post-transplant patients population.

Methods: A clinical pharmacist joined a multidisciplinary team consisting of nephrology and infectious disease to create and establish a HCV clinic specifically targeting renal transplant recipients with active infection. The clinical pharmacists created a treatment protocol tailored to the solid organ transplant population based on available data with DAA therapy. Within this clinic, the pharmacist evaluates each new renal transplant recipient referred for HCV treatment, gathering such information as past medical history, prior treatment for HCV, allergies, and current medications. This information is presented to the attending physician to determine candidacy for treatment. The clinical pharmacist then assists with treatment selection, prescribing and acquisition of the medications. With the assistance of a specialized HCV technician, the prior authorization process is streamlined allowing for the clinical pharmacist to document and evaluate vital data points to facilitate the initiation of therapy and proper follow-up.

Results: Our experience involving a clinical pharmacist participating within an outpatient HCV clinic setting has been successful for the patients as well as for other involved practitioners and the medical institution. The clinical pharmacist team has created a treatment algorithm to help guide therapy in the post-transplant population. Additionally, the introduction of a clinical pharmacist in the post-transplant HCV clinic and the addition of a specialized technician has streamlined the process for prior authorization and medication acquisition

Conclusion: Pharmacists play an important role in the outpatient management of HCV infection and are an asset to both providers and patients by ensuring appropriate treatment selection. These interventions provide the greatest opportunity for success with the newly available treatments, particularly in special patient populations. Additionally, with good documentation, clinical pharmacists can also play an important role in the acquisition of medications, which is beneficial to both patients and the institution.

6-013

Category: Ambulatory Care

Title: Herbal and supplement utilization in immigrants for the management of type 2 diabetes

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Purpose: According to the American Diabetes Association, 22 percent of people with diabetes use some type of herbal therapy and in another study 31 percent of people were found to use dietary supplements. The use of alternative medications such as herbs and supplements continue to rise in popularity and some ethnic groups (Hispanics, Native Americans, Asians and African Americans) are more likely to use dietary supplements and some of these herbals/supplements originate outside the United States. The purpose of this study was to identify which herbs and supplements are used among first generation Americans with type 2 diabetes.

Methods: Study participants were recruited from pharmacies in Southwest Houston, Cypress and Memorial City, Texas. Participants had to be adults over the age of 18; first generation American; and currently receiving treatment of type 2 diabetes; and using herbals or supplements in addition to their diabetes medications. This research was granted an exemption from IRB as it was a survey where confidentiality was maintained.

Results: Out of 100 patients who were screened, 33 participants met the inclusion criteria and completed the survey. The countries of origin of this participants included Nigeria (20/33), Mexico (7/33), Pakistan (3/33), India (2/33), and Vietnam (1/33). Most participants (85 percent) were between the ages of 41 and 15 percent were over the age of 65. The most commonly reported herbals and supplements were bitter melon (Momordica charantia), fenugreek (Trigonella foenum-graecum), gymnema (Gymnema sylvestre), cinnamon (Cinnamomun cassia), gingko (Gingko biloba), and prickly pear cactus (Opuntia spp.). Most patients reported that their pharmacist (60 percent) and physician (73 percent) were aware of their herbal/supplement use. Participants generally purchased their herbals/supplements from the local pharmacy or supermarket (94 percent), one purchased his online and one had his sent from his country of origin. Ninety-seven percent of participants reported that the herbal they use for the management of their diabetes is frequently used in their home country. All the participants except one believed their prescription medication was more effective than their herbal/supplement and 97 percent believe that their herbal/supplement helps manage their diabetes.

Conclusion: Many people continue to use of herbs and supplements for the management of diseases however none of these herbs/supplements have been recommended by the American Diabetes Association. Pharmacists must continue to educate patients on the lack of evidence on the efficacy of these agents. Since people are more inclined to try natural therapies, more definitive studies on the effects of these popular herbals and supplements must be conducted to inform on the efficacy of these herbals and supplements.

6-014

Category: Ambulatory Care

Title: Impact of clinical pharmacist-led annual wellness visits (AWVs) on use of acute care services

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Purpose: The Annual Wellness Visit (AWV) was developed in 2011 by the Affordable Care Act (ACA) and focuses on preventive care. Primary care physicians have created innovative, multidisciplinary strategies to implement these time-intensive visits, including utilizing the clinical pharmacist. To date, no studies have demonstrated whether or not these visits improve clinical outcomes for its beneficiaries. The purpose of this study was to determine whether AWVs are associated with reduced hospitalizations and emergency department (ED) visits.

Methods: This was an institutional review board approved retrospective cohort study assessing combined rates of hospitalizations and ED visits of patients seen by a clinical pharmacist for an AWV. All patients seen by a clinical pharmacist between April 1, 2012 and January 31, 2013 were included (n equals 69). The primary outcome was the mean number of combined hospitalizations and ED visits per patient in the year prior to and following the AWV. The secondary outcome was the total number of hospitalizations and ED visits before and after the AWV. Manual electronic chart review was completed to determine the number of hospitalizations and ED visits that occurred during each specified timeframe. Data are expressed as means. Evaluation of the primary and secondary outcomes utilized the Wilcoxon signed rank test and the sign test, respectively.

Results: The mean number of combined hospitalization and ED visits per patient in the year prior to the AWV was 0.59 compared to 0.33 in the year following the AWV (p equals 0.111). There were a total of 41 hospitalizations and ED visits in the year prior to the AWV and 23 in the year following (0.152).

Conclusion: There was no statistically significant reduction in combined hospitalizations and ED visits for patients seen by a clinical pharmacist for their AWV. However, given the absolute reduction in acute care visits, larger studies powered to detect a true reduction are warranted.

6-015

Category: Ambulatory Care

Title: Assessment of the effectiveness of pharmacy driven interventions to change prescribing practices of proper insulin needle lengths: a follow-up medication use evaluation

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Purpose: Insulin syringes and pen needles are available in multiple lengths because historically, most providers believed obese patients required longer needles. However a study by Gibney et. al. showed skin thickness is not correlated with obesity and is similar across the majority of patients. The study also demonstrated that risk of accidental intramuscular injection is lower with shorter needles. A study by Hirsch et. al. found that compared with longer needles, shorter needles are less painful, have higher patient satisfaction and result in similar glycemic control. Therefore, all patients using insulin should be using the shortest needles available.

Methods: In 2014, Pharmacy conducted a medication use evaluation (MUE) regarding the length of insulin syringes and pen needless prescribed between 1/1/13 and 12/31/13. The results of the MUE clearly demonstrated poor institutional compliance with the current practice guidelines. The data were shared with the Pharmacy and Therapeutics committee. A monthly prescribing tip addressing the issue was sent to all providers. Feedback from providers on the prescribing tip included that it was difficult to locate the shorter needles in the provider order entry system, and this issue was corrected by the institution's informatics manager. In order to assess the effectiveness of these Pharmacy driven interventions, another MUE was performed for prescriptions between 5/31/14 and 5/31/15.

Results: The first MUE performed in 2014 found 49 prescriptions for pen needles and 19 for syringes, excluding duplicate prescriptions such as refills. The percentage of patients prescribed 4 mm, 5 mm and 8 mm pen needles was 6.2%, 32.6% and 61.2%, respectively, and the percentage of patients prescribed 6 mm, 8 mm and 12.7 mm were 0%, 58% and 42% respectively. The second MUE performed in 2015 found 57 prescriptions for pen needles and 26 prescriptions for insulin syringes. The percentage of prescriptions for 4 mm, 5 mm, 8 mm and 12.7 mm pen needles were 3.5%, 85.9%, 8.7% and 1.7%, respectively. The percentage of prescriptions for syringes with a needle length of 6 mm, 8 mm and 12.7 mm were 7.6%, 42.3% and 50%, respectively.

Conclusion: Measures taken by Pharmacy in conjunction with the informatics department and Pharmacy and Therapeutics committee were successful in increasing compliance with practice guidelines of pen needles. The percentage of patients prescribed 5 mm pen needles increased from 32.6% to 85.9% while the percentage of patients prescribed 8 mm pen needles decreased from 61.2% to 8.7%. The interventions did not succeed in changing prescribing practices of syringes. Pharmacy will continue to work with providers, Pharmacy and Therapeutics and informatics to increase provider compliance and will assess the effectiveness of these measures with future MUEs.

6-016

Category: Ambulatory Care

Title: Retrospective analysis of medications prescribed to patients with type 2 diabetes mellitus

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Purpose: It is estimated that approximately 29 million Americans have diabetes. Of those 86% of diabetics are currently on some type of anti-diabetic medications, either alone or in combination. At a family medicine residency clinic, little is known about the medications prescribed to the diabetic patients beyond what is specified by quality metrics. The objective of the study is to determine what differences exist in the number of diabetic medications prescribed between patients with HbA1c less than 7.5% compared to those with HbA1c greater than or equal to 7.5%.

Methods: This study is a retrospective chart review of adult patients with type 2 diabetes (T2DM) that receive their care from a multi-physician family medicine clinic. This study was approved by the clinics Research and Quality committee as well as the governing investigational review board. All adult patients with T2DM seen at the clinic between 10/01/2015 to 12/31/2015 were reviewed. To be eligible for review, that patient must have had an HbA1c performed within 6 months of the specified time period. All data was extracted from the clinics electronic medical record. The following data was collected for each patient: age, sex, race, language spoken, number of co-morbidities, tobacco use, duration of T2DM, HbA1c, anti-diabetic medications prescribed, referral to patient centered medical home (PCMH) services and number of T2DM related encounters in past 12 months.

Results: A total of 303 patients were reviewed of which 59.4% were female. The average age of the patients was 57.5 (+/-11.7) years. The average HbA1c for the total number of patients was 7.2% (+/-1.8%). The average number of anti-diabetic medications prescribed to each patient was 1.5 medications. Patients had an average duration of diabetes was 8.2 years and the average number of co-morbidities present was 7. The two most frequently prescribed medications to patients were metformin and insulin with 68.1% and 23.6% respectively. There were 207 patients in the HbA1c less than 7.5% group and 96 patients in HbA1c greater than or equal to 7.5% group. The average number of medications prescribed to patients with an HbA1c less than 7.5% was 1.3 compared to 1.9 for those patients with an HbA1c greater than or equal to 7.5% ($p = 0.142$).

Conclusion: No statistically significant difference in the average number of medications prescribed when comparing patients with HbA1c below 7.5% to those with HbA1c greater than

or equal to 7.5% exists. Even though the number of medications was not different, there were some notable differences identified. In the group with the elevated HbA1c, there was a higher proportion of patients prescribed insulin as well as a higher proportion of minorities in that group. In order to improve patient care within the clinic, a comprehensive interprofessional diabetes management program will be implemented.

6-017

Category: Ambulatory Care

Title: Best interventions in lipid-lowering (BILL) study: an observational study of pharmacist-driven recommendations to optimize dyslipidemia therapy

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Purpose: The American College of Cardiology/American Heart Association 2013 Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults (ACC/AHA cholesterol guideline) introduced considerably different recommendations on the treatment of cholesterol relative to previous guidelines. Motivated by the revised guideline, the primary objective of this study was to optimize dyslipidemia medication regimens in primary care patients by discontinuing nonstatin therapies deemed unnecessary and optimizing statin therapy. Through patient-specific recommendations, this study aims to demonstrate the impact pharmacists interventions can make on pill burden through appropriate use of lipid-lowering medications.

Methods: An observational study was performed at 5 sites: 4 community health centers and a Program of All-inclusive Care for the Elderly. Eligible patients were identified through a search of the electronic medical records (EMR) databases using the following parameters: 55 - 79 years of age, diagnosis of dyslipidemia, primary care visit between January 1 - June 30, 2014, and active prescription for a nonstatin lipid-lowering medication. Patients were excluded if they had triglycerides >500 mg/dL, documented history of statin intolerance or allergy, transferred care/deceased, or lipid-lowering regimen optimized by provider prior to pharmacists interventions. Demographic and clinical information were collected to determine appropriate treatment of dyslipidemia and patient-specific recommendations in concordance with the ACC/AHA cholesterol guideline. Pharmacists educated providers on the focus of the ACC/AHA guideline to optimize statin therapies and limit the use of nonstatin medications. Pharmacists patient-specific recommendations were communicated to each provider via the EMR system. The numbers of communicated and accepted or declined recommendations were documented to measure the primary outcome. Descriptive and inferential statistics were used to analyze data. Institutional Review Boards for each practice site and Northeastern University approved this study.

Results: Of the 219 patients screened, 116 patients were excluded; 27 for documented statin intolerance or allergy, 36 for incidence of triglycerides >500 mg/dL, 11 transferred care or deceased, 34 were previously optimized by their provider, and 8 were on nonstatin therapies for conditions other than lipid-lowering. There were 103 patients that met the studys eligibility criteria and 164 recommendations were made related to lipid-lowering therapies. For all eligible patients, the average age was 65.5 7.0 years old, mostly female 57.6%, and ethnically diverse; 48.6% white, 18.9% black and 32.4% other (i.e., Asian, Latino/Hispanic). For the 103 patients in whom recommendations were made, the following nonstatin medications were deemed unnecessary and discontinuation was recommended: omega-3 fatty acids (77), gemfibrozil (13), fenofibrate (5), niacin (6), and ezetimibe (4). In total, 105 medications were eligible for discontinuation. Additionally, 59 recommendations were made to initiate a statin or increase statin intensity. As of June 15, 2015, a total of 36 recommendations were accepted by providers for implementation by pharmacists (8) or providers (28), 4 recommendations were declined either by provider or patient refusal, and 124 are pending provider response and/or patient consultation.

Conclusion: Through consideration of comorbidities, application of clinical judgment, and incorporation of the 2013 ACC/AHA cholesterol guideline, pharmacists were able to provide patient-specific recommendations to discontinue unnecessary nonstatins, optimize statin therapy as indicated, and decrease pill burden in the study population. Based on preliminary findings, providers seem receptive to pharmacist-led education and are accepting the recommendations, further demonstrating pharmacists value on these interdisciplinary teams. For continued integration of the ACC/AHA cholesterol guideline into practice, the educational components should be routinely reinforced by pharmacists at each site to maintain consistency among providers approach to management of dyslipidemia in the patient population.

6-018

Category: Ambulatory Care

Title: Evaluation of therapeutic interventions and clinical outcomes in a pharmacist-run pharmacotherapy service in a free clinic

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Purpose: The purpose of this study was to quantify the frequency and type of pharmacist interventions in a pharmacotherapy clinic and examine their impact on disease specific parameters in an underserved patient population.

Methods: A retrospective chart review was conducted in a free clinic setting utilizing a collaborative practice agreement. Patients enrolled in the pharmacotherapy clinic between March 2011 and June 2013 with a minimum of two follow-up appointments, laboratory values, and vital signs were eligible for inclusion. A standardized assessment tool was utilized to collect data regarding the type and frequency of pharmacist intervention. Hemoglobin A1c, systolic and diastolic blood pressure (SBP, DBP), and low-density lipoprotein (LDL) were evaluated at baseline, 6 and 12 months after enrollment in the pharmacotherapy clinic. Paired t-tests were used to compare outcome data after pharmacotherapy clinic intervention with patients baseline measurements. A Chi-square test was used to compare percentage of patients meeting disease state goals before and after pharmacotherapy clinic intervention. This study was IRB approved.

Results: Thirty-two patients (mean age 49.8 plus or minus 7.3 years) were included. Baseline A1c and SBP were 10.4 plus or minus 2.3 percent and 130.7 plus or minus 14.3 mmHg, respectively. A total of 399 medication-related problems (mean 2.1 per visit) and 525 pharmacist interventions (mean 2.8 per visit) were identified. The most commonly identified medication related problems included inadequate lifestyle or non-drug variables (30 percent), inadequate drug dosing (19 percent), and non-adherence (13 percent). The most common pharmacist interventions included patient education (49 percent), dose change (16 percent), and ordering laboratory values (14 percent). The number of patients achieving A1c goal (less than 7 percent) increased from 3.3 percent at baseline to 20.8 percent at 6 months (p equals 0.0001) and 14.3 percent at 12 months (p equals 0.0093). The percentage of patients with LDL levels less than 100mg/dL increased from baseline (31.3 percent) to 42.9 percent at 6 months and 40.0 percent at 12 months (not significant). In patients with baseline LDL greater than 100mg/dL, mean LDL decreased from 139.1mg/dL at baseline to 102.8mg/dL at 6 months (p equals 0.007) and 113.1mg/dL at 12 months (p equals 0.111). No significant change was found in blood pressure.

Conclusion: Diabetic control improved in underserved patients receiving pharmacist medication management. Significant LDL reduction was also demonstrated at 6 months in patients with LDL greater than 100mg/dL at baseline. When providing care for an underserved patient population, pharmacists were able to identify a variety of medication related problems. The most common resulting intervention involved providing necessary patient education.

6-019

Category: Ambulatory Care

Title: Impact of pharmacist insulin managment on hemoglobin a1c in outpatient hospital clinic setting

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Purpose: The primary objective of this study was to assess the impact that pharmacists can have on patients hemoglobin A1C through management of insulin over 3 months. Secondarily, the change in weight over the initial 3 months following their initial clinic visit and the change in hemoglobin A1C at 6 months was also assessed.

Methods: The ethics committee (Pharmacy and Therapeutics Committee) approved this retrospective evaluative study and determined that informed consent was not required. A total of 49 patients were referred to the Licking Memorial Hospital (LMH) Outpatient Medication Therapy Insulin Clinic by their endocrinologist during the designated time frames of the study. Pharmacists were able to fully manage the patients insulin regimens through the endocrinologists authorization for clinical monitoring and dose adjustment per LMH insulin management Policy and Procedures and approved Insulin Dosing Guidelines. Hemoglobin A1C values were collected through the patients electronic medical records. Patients were included in the study if their initial hemoglobin A1c was within 12 weeks before or 4 weeks after their initial clinic visit. Also, their first follow-up A1c must have been drawn within 4 to 20 weeks following their initial clinic visit. Patients were excluded from the study if they did not show up to the initial clinic visit or failed to follow-up within 20 weeks after their initial clinic visit. The change in hemoglobin A1c over time was calculated and assessed. We also evaluated change in hemoglobin A1c after 6 months and change in weight over time.

Results: Of the 49 patients referred, 35 met the inclusion criteria. Five of the 14 excluded patients did not show up to their initial clinic visit and nine came to the first appointment but never followed up. An average decrease in hemoglobin A1c of 0.8 percentage points was observed over an average of 83 days. However, an average increase in weight of 0.2 pounds was seen over the 83 days. A second follow-up was also performed which included data on six patients who had an additional hemoglobin A1c decrease of 0.1 percentage points following the first change in hemoglobin A1c.

Conclusion: Pharmacist insulin management is an innovative pharmacy service in which clinical pharmacists can have an impact on patients hemoglobin A1c. Therefore, pharmacist intervention could play a vital role in outpatient insulin management

6-020

Category: Automation / Informatics

Title: Southwest general hospital electronic medication reconciliation: using pharmacy technicians to improve the process

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Purpose: Medication Reconciliation has been a continuous area of improvement since its inception. We recently implemented electronic medication reconciliation as part of our electronic health record. With the complexity of home medication regimens, it has become increasingly difficult to get an accurate record of the medications patients take at home. We looked at the practice of having a pharmacy staff member obtain an accurate and complete medication list on admission. Furthermore, this individual would be solely dedicated to tracking down all of the proper information related to the patients home medication regimen.

Methods: We put the process in place of having a pharmacy technician gather patients medication information in the ED as part of the admitting process. The goal of the program was to provide the MD with an accurate home med list including drug name, dose, and frequency. This would allow the doctor to complete the patients electronic medication reconciliation quickly and accurately. The patients were asked about prescription drugs, any over the counter drugs and herbal medications that they currently take (including the timing of the last dose). If they were unable to supply an accurate medication list, patient family members , their local pharmacy , or their doctors office was contacted for medication history. Once an accurate medication list was obtained, the pharmacy technician entered the medication list into the electronic health record. After completion, the pharmacy technician contacted the patients prescribing practitioner and informed them the patient was ready for electronic admission medication reconciliation. The provider then accessed the electronic health record and performed admission medication reconciliation.

Results: Prior to the program being instituted, 393 medication reconciliations were analyzed. 359 (91%) were incomplete or contained a deficiency. The completion percentage of electronic medication reconciliation in the electronic health record was 23.8%. This was far below the Stage 2 meaningful use goal of 50%. After the implementation of the program, electronic medication reconciliation was at 67.4% (12 months later). The program has also caused the number of medication orders entered electronically to change from 33.6% to 82% over the same 12 month period.

Conclusion: Our results showed that having a pharmacy technician interview patients on admission and obtain a complete medication list, will lead to a greater number of electronic medication reconciliations performed. This has also caused a substantial increase in medication orders via computerized physician order entry. We have found this to be of great benefit to the safety of the patient in the hospital. We have also seen an increase in physician satisfaction with electronic medication reconciliation and our electronic health record. We are continuing to

expand the program into labor and delivery, outpatient surgery, and direct admission from local physician offices.

6-021

Category: Automation / Informatics

Title: Evaluation of mandatory questions during levofloxacin computerized prescriber order entry (CPOE) as part of an antimicrobial stewardship initiative

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Purpose: Providing effective antimicrobial therapy while minimizing bacterial resistance requires a clear assessment and plan. One of the core elements of hospital antibiotic stewardship programs, as recommended by the Centers for Disease Control (CDC), is to require prescribers to document in the medical record or during order entry a dose, duration, and indication for all antibiotic prescriptions. At our institution, a clearly stated indication and planned length of therapy was frequently missing from the electronic medical record. This project was designed to capture this core element with levofloxacin and facilitate a more appropriate length of therapy.

Methods: The Antimicrobial Stewardship Program (ASP) and the inpatient Physician Advisory Group (iPAG) approved a set of mandatory questions that require an answer by the prescriber each time an antibiotic is ordered through computerized prescriber order entry (CPOE). The mandatory questions include indication and planned duration. Prior to implementation, education was sent via e-mail to all prescribers, pharmacists and nursing caregivers explaining the urgent need to slow the emergence of antibiotic- resistant bacteria and to prevent the spread of resistant infections. Ongoing interventions include education through newsletter articles and multidisciplinary rounding. An ASP approved guideline for empiric treatment of common infections including recommended length of therapy was also e-mailed to the above groups. Data on the mandatory questions were collected for levofloxacin during the first three weeks after instituting the mandatory questions. A daily report of active inpatient levofloxacin orders was generated and analyzed Monday through Friday. Orders were categorized by indication and compared to assess prescribing trends. Actual versus planned length of therapy were compared directly.

Results: Over the course of 17 days in May/June 2015, 104 orders were examined. The most common documented indication was pneumonia: 51 percent, followed by urinary tract infections (UTIs): 20 percent, intra-abdominal infections (IAIs): 11 percent and skin and soft tissue infections (SSTIs): 5 percent. An indication option of "Other: See comments" was used in 13 percent of orders. Other indications included sinusitis, neutropenic fever, COPD exacerbation, surgical prophylaxis and septic arthritis of the knee. The mean anticipated duration, obtained from the initial length of therapy that prescribers selected during order entry was 6.5 plus/minus

4.4 days (range 1-42 days). The actual mean length of therapy was 6.6 plus/minus 5.5 days (range 1-42 days). Looking at trends in levofloxacin prescribing, the proportion of orders for pneumonia and UTIs declined over the course of the 17 days, whereas the proportion of orders for IAIs and SSTIs increased.

Conclusion: Requiring prescribers to document the indication and anticipated length of therapy at the time of order entry may have helped to reduce patient exposure to antibiotics. The actual length of therapy was closely matched to the duration initially planned. A previous levofloxacin medication use evaluation in May/June of 2014 revealed a mean length of therapy of 8.2 plus/minus 3.6 days (range 1-17 days). Other ASP initiatives, in addition to providing prescribers a guideline with empiric antibiotic choices and suggested duration of therapy, also may have helped decrease total duration of levofloxacin use compared to the prior year.

6-022

Category: Automation / Informatics

Title: Implementation of a computerized prescriber order entry system in a community hospital from a pharmacy perspective

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Purpose: Medication errors cause significant morbidity and mortality in hospitalized patients but computerized prescriber order entry (CPOE) implementation has been associated with a decrease in such inaccuracies. Reductions in medication errors can be partially attributed to the employment of clinical decision support, directing providers to select appropriate drug therapy, dose, and identify potential drug interactions. In addition to decreasing adverse drug events, utilization of CPOE has been associated with reduction in order processing time. This study evaluated the implementation of a CPOE system in a community hospital and assessed trends of reported errors.

Methods: This was a mixed retrospective and prospective, single center, observational study that was IRB exempt. We evaluated the number and type of medication errors reported by pharmacists in an institutional quality and risk database prior to CPOE implementation retrospectively (February to April 2014) and prospectively (February to April 2015) at our institution. In addition to reviewing the database, all medication orders included in the retrospective data were reviewed to ensure they met the inclusion criteria. The primary outcome was to compare the number and type of medication errors reported before and after the transition to CPOE. This study also reviewed medication advisories that were inappropriately overridden during this study period.

Results: Among 566 total errors identified, 271 met the inclusion criteria (152 errors in the pre-implementation phase and 144 errors in the post-implementation phase). After CPOE implementation, there was a statistically significant reduction in incomplete/incorrect PRN indications (p equals 0.04), incomplete/incorrect route (p equals 0.009) and drug-allergy interactions (p equals 0.023). There were also reductions in errors related to duplicate therapy, incomplete/incorrect dose, incomplete/incorrect dosage form, incomplete/incorrect rate, incomplete/incorrect medication, contraindicated medications and illegible orders. Certain errors were found to increase after the implementation of CPOE, the most apparent being incomplete/incorrect frequency or timing. Other errors noted to increase included incomplete/incorrect duration and drug-drug interactions, however none were found to be statistically significant. The most common reason for inappropriate alert overrides included patients will be monitored.

Conclusion: Implementation of CPOE led to a statistically significant decrease in drug-allergy interactions, incomplete/incorrect PRN indications and incomplete/incorrect route. The increase in incomplete/incorrect frequency or timing could be attributed to the newly added responsibilities of the physicians with selecting appropriate medication administration timing. Through this study, areas requiring additional prescriber training and pharmacist vigilance were identified, which will be utilized in future phases of CPOE. Additionally, review of inappropriate alert overrides identified the need to optimize medication error alerts for providers.

6-023

Category: Automation / Informatics

Title: Students' perception on the value of virtual worlds for clinical pharmacy education in Northern Sweden

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Purpose: The clinical pharmacy course at Umea University is almost entirely a web-based course. In the course, the students are provided with opportunities for training in simulated ward rounds and patient meetings in OpenSim (a virtual world software), where the students can practice communication with patients and colleagues in a professional manner. This study aims to explore the views of fourth year pharmacy students on the value of virtual worlds for clinical pharmacy education.

Methods: An online course evaluation was administered to students after they completed their fourth year clinical pharmacy course. The questionnaire consisted of two parts; satisfaction with the use of the virtual world as well as overall satisfaction with the course. Students were asked to rate statements on a 5 and 6-point Likert-scale and were also given the opportunity to comment on each one of the domains.

Results: Forty two students completed the online course evaluation (62% response rate). The majority of students (83%) reported they were able to adopt the role of clinical pharmacist in the virtual world. The students described their experience as "new and exciting", "fun" and some described it as "a way to ease into the role". It allowed them to get a visual picture of how a meeting might look. Sixty percent reported that the environment felt authentic even though some noted that "it can never be quite the same as sitting next to a real person to talk". More than half of the students (66%) described the use of virtual world as a worthwhile exercise. Some students commented that they spent too much time dealing with the technical aspects which detracted them from their course as evidenced by this student's comment: "it occupies valuable study time that can be spent on other things". The majority (93%) rated the overall quality of the course as good or very good with 76% reporting the pedagogical design of the course helped them with their studies.

Conclusion: Students at Umea University value the use of virtual worlds in clinical pharmacy teaching. However there is a need to make the virtual environment more realistic and easier to use. The invaluable feedback from students will help improve the future use of virtual words in pharmacy education. These results may help other universities considering using virtual worlds for clinical pharmacy education.

6-024

Category: Automation / Informatics

Title: SharePoint development and implementation in a tertiary care center in Lebanon

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Purpose: To describe the experience of developing and implementing a pharmacy SharePoint as a single resource point to ensure effective and user-friendly communication and documentation of clinical interventions in a tertiary care center The American University of Beirut Medical Center is a 350-bed capacity tertiary care teaching hospital in Lebanon. The pharmacy operates 24/7, with an order-management scanning system and a comprehensive Unit-based model where the pharmacists are assigned to Adults, Pediatrics, Oncology, Operation and night shift teams.

Methods: This new structure led to increased challenges in communicating information within the department. Communications were mainly through e.mails, multiple steps to access favorite Web pages, and manual documentation to capture and track clinical activities (e.g. clinical rounds, chart documentation, time spent on the unit, follow up on restricted antimicrobial use and multidisciplinary meetings). The configuration of the pharmacy home page and the content was agreed upon with the IT department and the pharmacists team leaders. The home page includes links to frequently utilized external medical resources (e.g. Micromedex, Medscape, out-patients formulary for third party-payers), and internal information (e.g. policies and procedures, order sets and protocols). Within the clinical services area are treatment algorithm, standardized drip protocols, guidelines, stability sheets, compounding instructions and Formulary. The shared applications include scheduling, calendar to reserve annual vacation, and parenteral nutrition software. Likewise, announcement section with temporary links was added to the home page to draw attention to important but transient information, such as an announcement for drugs in shortage, availability of newly approved drugs. Hierarchy of restriction was set with different access levels as owners, members and visitors and an alert setting was customized to provide e-mail alerts when information is updated or added.

Results: Preliminary impression after site initiation and training of team leaders and staff pharmacists indicate that SharePoint is an improved method of communicationstorage documentation. Future challenges would include: 1) training material and annual competency programs for pharmacists and technicians. 2) Survey to get staff feed-back after full implementation 3)The major future challenge is to persuade the pharmacist to make use of it. Currently, under development are quick launch buttons to document clinical activities and place follow up note on the inpatients dashboard using a scroll down option with the ability to generate reports to compile and analyze the data; this will accessible through I-pads and smart phones.

Conclusion: Pharmacy SharePoint offers many applications to improve communication and achieve real-time capture of meaningful benchmarking data, but staff adoption and utilization of this resource will be the keys to success

6-025

Category: Cardiology / Anticoagulation

Title: Evaluating appropriate dosing of direct oral anticoagulants (DOAC) in a family medicine practice

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Purpose: To date, four direct oral anticoagulants (DOACs) that do not require routine anticoagulation monitoring, dabigatran, rivaroxaban, apixaban, and edoxaban, have been approved in the United States. However, these remain high risk medications that require renal dose adjustments and carry significant drug interactions. Thus, proper monitoring according to prescribing information is necessary to minimize drug therapy related problems and provide safe patient care. The purpose of this study was to determine if patients prescribed these medications in a primary care setting are taking doses appropriate based on patient specific factors including renal function and concomitant medications.

Methods: This study was an institutional review board approved retrospective chart review. All patients age 18 or older who were prescribed dabigatran, rivaroxaban, apixaban, or edoxaban by their primary care provider were included in the study. Patients were excluded if these agents were prescribed by outside providers, were actively monitored by another clinic, or were cared for in a skilled nursing facility. Patient charts were reviewed for appropriateness of DOAC dose as recorded in their medication lists as of June 1, 2015. Appropriate doses were determined based on indication, interacting medications, and most recent serum creatinine or creatinine clearance. The primary outcome was the percentage of patients prescribed inappropriate doses of DOACs based on manufacturer recommendations for indication, interactions, and renal function. Secondary outcomes included reasons for inappropriate dosing, percentage of patients taking appropriate doses but are borderline for dose change (i.e. based on renal function or lack of serum creatinine in last 12 months), and the number of patients taking interacting medications. Descriptive statistics are used to present the data.

Results: Sixty-three patients taking DOACs met inclusion criteria; 9 patients were taking dabigatran, 37 taking rivaroxaban, and 17 taking apixaban. No patients were taking edoxaban. Of all patients taking DOACs, 16 out of 63 (25.4 percent) were found to be on incorrect doses according to prescribing information. Reasons for incorrect doses included the following: patients older than 80 years prescribed dabigatran at any dose (4 of 16); incorrect or lack of renal dose adjustment for rivaroxaban (5 of 16); inappropriate dose reduction based on weight, serum creatinine, and age for apixaban (2 of 16); contraindication based on creatinine clearance less than 25 for apixaban (1 of 16); and lack of FDA-approved indication (4 of 16). Of patients that

were taking appropriate doses, 16 out of 47 (34.0 percent) were considered borderline for dose change, 15 of which were patients who had not had a serum creatinine level within the last 12 months. In total, 32 out of 63 patients (50.8 percent) were identified as being on incorrect doses or borderline for dose change. One out of 63 patients was found to be taking interacting medications.

Conclusion: DOAC use was suboptimal when prescribed within our family medicine practice. Efforts to improve safe use of these medications including more structured monitoring should be considered and implemented.

6-026

Category: Cardiology / Anticoagulation

Title: Reversal of rivaroxaban with a factor IX complex for an emergent procedure

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Case Report: This case report describes reversal of rivaroxaban utilizing factor IX complex for a patient requiring emergent pacemaker placement. This patient is an 80 year old female with a history of atrial fibrillation on rivaroxaban 15 mg by mouth at bedtime for stroke prevention. Prior to admission to the hospital, it was identified that the patients heart rate was 37 beats per minute, despite a normal blood pressure. On admission, patient was given atropine without response and the diagnosis of sick sinus syndrome was made by the cardiologist. She continued to have bradycardia with heart rates in the 20s on telemetry and a 12-lead EKG confirmed a ventricular rate of 33 beats per minute. She was transferred to the cardiac care unit and per the cardiology team was to continue anticoagulation with rivaroxaban because the patient was not interested in a pacemaker procedure at that time. Overnight, the patient had two symptomatic episodes of bradycardia and the decision was to proceed with a pacemaker placement that day following reversal of rivaroxaban with a factor IX complex. Prior to the procedure, the patients INR was 2.3, Hb 11.6 mg/dl, and Scr 1.85 mg/dl. The patient received two doses of a factor IX complex, each dose was 25 units/kg. The first dose was administered thirty minutes prior to the procedure, followed by the second dose one hour and forty minutes later. The day after the procedure, the patients INR was 1.5, Hb 11.5 mg/dl, and Scr 1.46 mg/dl. There were no signs or symptoms of bleeding documented post-procedure. She was discharged home with instructions to restart her anticoagulation with rivaroxaban within one week. Current recommendations are to discontinue rivaroxaban at least 24 hours prior to surgery or other procedure to reduce the risk of bleeding, however data is limited if a procedure needs to occur prior holding the dose for 24 hours. Case reports have suggested a role for factor IX complex for emergent procedures, but there is no standardized dosing. As this case report suggests, utilizing factor IX complex at a total dose of 50 units/kg at the time of the procedure can result in appropriate reversal of rivaroxaban.

6-027

Category: Cardiology / Anticoagulation

Title: Utilization of Prothrombin Complex Concentrate for the Reversal of Life Threatening Bleeding due to Warfarin in a Community Hospital

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Purpose: The 2012 CHEST guidelines recommend the use of a four-factor prothrombin complex concentrate (PCC) along with intravenous phytonadione for rapid reversal of warfarin for patients with life-threatening bleeding. Hillcrest Hospital, a Cleveland Clinic hospital, began using a four-factor PCC in 2014 as part of a health system approved algorithm. The purpose of this evaluation is to assess compliance with the algorithm, effectiveness of PCC on international normalized ratio (INR) correction, and patient outcomes.

Methods: A retrospective chart review was conducted for patients treated at Hillcrest Hospital from May 2014 to May 2015 with PCC to reverse warfarin due to a life- threatening bleed. Data collection included: patient demographics, site of bleeding, trauma involvement, baseline and post dose INR value, dose and route of phytonadione, physician specialty, and patient outcome upon discharge. Additional data included: dose of PCC, time to follow-up INR, and incidence of adverse drug events.

Results: A total of 32 patients received PCC at Hillcrest Hospital during the study period. Fifteen of these patients were the result of a trauma. Twenty-one patients had a neurological bleed. Eight patients presented with a gastrointestinal bleed. Two patients required reversal for emergent surgery and one patient had uncontrolled bleeding from a fistula. All but one patient was receiving warfarin. This patient presented with an elevated INR while on rivaroxaban. The median dose was 2000 units or 25 units/kg. Thirty or 93.8% of these doses were appropriate according to the algorithm. One patient received a 20 units/kg dose when they should have received 10 units/kg . The second patient received 25 units/kg but had been taking rivaroxaban. All patients were ordered phytondatione 10 mg intravenously. The median baseline INR was 2.55 (range 1.6 to greater than 9) and the median post dose INR was 1.2 (range 1.1 to 2.3). The median time to follow-up INR was 86 minutes (range 19 to 780 minutes) with a target of 30 minutes. Twenty-five patients were discharged home or to another facility. Seven patients either expired while in the hospital or were discharged with hospice. None of the patients experienced an adverse event.

Conclusion: Utilization of PCC along with intravenous phytonadione at Hillcrest Hospital for the rapid reversal of life-threatening bleeding appears safe and effective when appropriately

following the health system approved dosing algorithm. Provider and nursing education will be implemented in order to improve appropriate use and reduce time to follow-up INR.

6-028

Category: Cardiology / Anticoagulation

Title: Evaluation of efficacy and side effects of Rivaroxaban, Dabigatran, and Apixaban at a community medical center

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Purpose: Oral anticoagulants are the mainstay for the treatment of atrial fibrillation and the treatment/prevention of venous thromboembolism. Previously, the only oral pharmacologic agent available was warfarin which is unfortunately characterized by a variety of drug and diet interactions, constant monitoring and bleeding. The approval of the novel oral anticoagulants (NOACs) rivaroxaban, apixaban and dabigatran has changed the landscape of oral anticoagulation. These agents have a rapid onset, less drug and diet interactions and require no monitoring. The purpose of this study was to evaluate the efficacy and side effects of rivaroxaban, dabigatran, and apixaban at our medical center.

Methods: Electronic medical records were utilized to identify patients who were greater than the age of 18 and who were receiving a NOAC prior to and during hospitalization between 1/1/14 and 12/31/14. This data was compared with a report of patients who received a NOAC or warfarin during their hospitalization. Efficacy of therapy was measured by evaluating the number of patients presenting to the facility with new onset venous thromboembolism (VTE). Safety was measured by evaluating the number of patients with hemorrhage present on admission as well as the number of patients requiring blood transfusion throughout hospitalization.

Results: A total of 1561 patients received one of the new oral anticoagulants: rivaroxaban, apixaban or dabigatran. Three- hundred eighty-eight received rivaroxaban, 100 received apixaban and 148 received dabigatran. For rivaroxaban, one patient had a documented hemorrhage present on admission and 41 patients required transfusion during their hospitalization. The median number of units transfused was 2 units. For apixaban, one patient had a documented hemorrhage present on admission and 15 patients required transfusion during their hospitalization with a median of 3 units. For dabigatran, there were no patients with a documented hemorrhage on admission however 10 patients required blood transfusion during hospitalization with a median of 8.5 units. Patients who received warfarin for this time period were also evaluated. A total of 1468 patients received warfarin. For these patients, three had a hemorrhage present on admission and 315 required transfusion during their hospitalization. The median number of units transfused was 2. There were four patients who presented with a VTE and had been on treatment with rivaroxaban prior to admission however the dosing was that for

atrial fibrillation. Two of the patients had been on warfarin and their INR was sub-therapeutic on admission.

Conclusion: The new oral anticoagulants provide a new therapeutic option for anticoagulation therapy. Their safety and efficacy is on par with warfarin. Continued assessment of the patient is necessary to ensure that the patients dose is appropriate.

6-029

Category: Cardiology / Anticoagulation

Title: Retrospective Evaluation of the Utilization of Phytonadione (Vitamin K1) in the Management of Excessive Warfarin-Induced Anticoagulation

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Purpose: Warfarin is the most prescribed oral anticoagulant in the United States. The anticoagulant effect of warfarin can be measured by the international normalized ratio (INR). Phytonadione (vitamin K1) reverses the action of warfarin and lowers the INR. The 9th American College of Chest Physicians (ACCP) Guidelines on Antithrombotic Therapy and Prevention of Thrombosis provide recommendations for management of supratherapeutic INR. The purpose of this study is to assess physician compliance with ACCP guidelines for reversal of warfarin-induced excessive anticoagulation in a community hospital, and the effect of guideline compliance on hospital length of stay (LOS) and cost per case.

Methods: The hospital clinical cost accounting system was utilized as the primary data collection source. Any data not available via the clinical cost accounting system was obtained from the electronic medical record. Inpatients with an INR ≥2 between 1/1/2013 and 3/31/2014 were included in the study. Patients were excluded if they were <18 years of age, had liver disease, or were on oral anticoagulants other than warfarin. Patients were divided into 3 cohorts: active bleeding, INR >10 without bleeding, and INR 4.5-10 without bleeding. Guideline compliance was assessed for all 3 groups. LOS and cost per case were compared between compliant and noncompliant cases. Two sided p-values (alpha = 0.05) were calculated using Student's t-test for continuous data and Fisher's exact test for nominal data.

Results: 859 patients met inclusion criteria. 714 had bleeding, 9 had INR >10 without bleeding, and 136 had INR 4.5-10 without bleeding. Overall guideline compliance was 15.0%. 5.9% of bleeding cases were compliant. Cases without bleeding and INR >10 or INR 4.5-10 showed 66.7% and 61.0% compliance, respectively. Reasons for noncompliance in bleeding patients included: no phytonadione (35.6%), oral phytonadione (32.6%), and subcutaneous phytonadione (24.4%). In patients with INR >10 without bleeding, noncompliance was due to route of phytonadione administration other than oral (33.3%). For patients with INR 4.5-10 without bleeding, noncompliance was due to unnecessary administration of phytonadione (39.0%). Compliant bleeding cases showed mean LOS of 6.74 days versus 8.31 days for noncompliant (p=0.12). INR >10 without bleeding exhibited mean LOS of 3.83 days for compliant versus 2.67 days for noncompliant cases (p=0.46). Compliant cases with INR 4.5-10 without bleeding exhibited mean LOS of 4.39 days versus 6.17 days for noncompliant (p=0.001). Analysis of cost per case revealed $12,987 for compliant bleeding patients versus $15,456 for noncompliant (p=0.32). Compliant cases with INR >10 without bleeding cost $5,044 versus $3,837 (p=0.39)

for noncompliant. Compliant cases with INR 4.5-10 without bleeding cost $6,799 versus $9,261 (p=0.009) for noncompliant.

Conclusion: Compliance with the 9th ACCP Guidelines on Antithrombotic Therapy and Prevention of Thrombosis can be improved at this institution. The clinical consequences of noncompliance were most clearly demonstrated within the INR 4.5-10 group, displaying significantly longer LOS and cost per case versus compliant cases. In bleeding patients, 79.8% of parenteral phytonadione doses were administered subcutaneously, a practice the guidelines advise against due to variable pharmacokinetics and incomplete absorption. Reducing subcutaneous administration would improve compliance in bleeding patients and potentially improve clinical outcomes.

6-030

Category: Cardiology / Anticoagulation

Title: Outcomes associated with implementation of heparin infusion dosing recommendations in morbidly obese adult inpatients

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Purpose: .Limited data has shown morbidly obese patients require a higher total dose of unfractionated heparin (UFH) to achieve therapeutic anticoagulation, but less UFH per kilogram compared to non-obese patients. A previous institutional analysis resulted in a change in initial UFH infusion dosing recommendations for patients weighing 150 kg or greater to 11 units/kg/hr for non-venous-thromboembolic (VTE) indications and 13 units/kg/hr for VTE indications with no dose capping. The purpose of this study was to evaluate prescriber adherence to the new dosing recommendations and compare anticoagulation outcomes between guideline adherent and non-adherent dosing.

Methods: .The institutional review board approved this single center retrospective cohort analysis of patients who weighed150 kg or greater, treated with therapeutic UFH from April 15, 2013 to April 30, 2014. Patients included were at least 18 years of age, weighed 150 kg or greater, received at least 24 hours of UFH and achieved two consecutive goal aPTTs. The primary outcomes were time to first therapeutic aPTT and infusion rate at time of first therapeutic aPTT. Secondary outcomes were recommendation adherence rates and the number of dose adjustments and laboratory blood draws required before achieving therapeutic anticoagulation.

Results: .The average weight was 180 kg. VTE was the indication for heparin infusion in 56% of the patients. The dose recommendation for the morbidly obese was used in 30% of the patients evaluated. The average UFH dose at first therapeutic aPTT was 12.3 and 14.3 units/kg/hr for non-VTE and VTE indications, respectively. The average time to first therapeutic aPTT was 20.3 hours with recommendation adherence versus 51.8 hours with recommendation non-adherence (P=0.013). The number of dose adjustments and aPTT lab draws doubled when dosing recommendations were not followed.

Conclusion: .Patients achieved therapeutic anticoagulation significantly sooner with adherence to the morbidly obese heparin infusion dosing recommendations. Dosing non-adherence lead to a delay in therapeutic anticoagulation of over 48 hours and also lead to an increase in laboratory draws and dosing adjustments. Multidisciplinary education on heparin infusion dosing in morbidly obese patients may lead to improvements in anticoagulation and patient outcomes as well as a decrease laboratory draws and decrease nursing workload.

6-031

Category: Chronic / Managed Care

Title: Examining the prevalence of opioid dependent patients receiving buprenorphine/naloxone and methadone concurrently

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Purpose: Opioid abuse is a growing epidemic, with nearly 1.8 million people in America diagnosed with opioid use disorder, according to the 2013 National Survey on Drug Use and Health. Current treatment approaches include methadone treatment programs and physician-prescribed buprenorphine/naloxone. This study aims to identify patients who are prescribed buprenorphine/naloxone for opioid dependence and are concurrently receiving methadone. The composed data is meant to assess for potential gaps in the Massachusetts Prescription Monitoring Program. The data collected will bring awareness to incorrect co-administration of opioids and will improve patient safety and efficacy in substance use disorder treatment.

Methods: A retrospective observational study was conducted analyzing one Massachusetts health plan's data over the period of April 2015 to May 2015. A managed care organization's claims databases were used to determine select patients who were receiving opioid replacement therapy with buprenorphine/naloxone and methadone. Patients were selected based on the presence of claims for buprenorphine/naloxone and methadone treatment and eligibility within the plan for the entire research period. Selection criteria included patients with an opioid dependence diagnosis prescribed buprenorphine/naloxone with a prescription or medical claim for methadone. Provider data was collected for all prescriptions to analyze for the presence of multiple prescribers for each patient. It was also noted if patients were on both buprenorphine/naloxone and methadone with another drug of abuse. The drugs of abuse that were flagged included opioid analgesics, benzodiazepines, gabapentin, stimulants, and hypnotics. Exclusion criteria included patients who were not members of the specified health plan or part of the managed care organization's network. Patient profiles were used to examine this data to describe an existing means of diversion with the Massachusetts Prescription Monitoring Program.

Results: During the time frame of April 2015 to May 2015, claims data showed a total of 3,124 members on buprenorphine/naloxone therapy within one health plan. Of this population, 45 distinct members had claims for both buprenorphine/naloxone and methadone. Within this sample, 1 member was flagged for a concurrent methadone prescription claim and 44 members had methadone concurrency based on medical claims submitted for methadone daily dosing. Of

45 members between 22 to 62 years of age, 62 percent were male, and 38 percent were female. Racial demographics showed that 73 percent were white/American. In addition to the concurrency of opioid dependence treatment methods, 62 percent (n=28) of the population were on additional medications of abuse. Of this sample, 29 percent were prescribed opioid analgesics (hydromorphone, oxycodone/acetaminophen, oxycodone, and tramadol), 36 percent benzodiazepines (alprazolam, diazepam, lorazepam, and clonazepam), 57 percent gabapentin, 36 percent stimulants (mixed amphetamine salts), and 7 percent hypnotics (zolpidem). From the 28 members on additional medications of abuse, 82 percent involved multiple prescribers.

Conclusion: Concurrent use of methadone in patients prescribed buprenorphine/naloxone is a silent threat to managed care organizations, providers, and patients. The Prescription Monitoring Program is used to capture misuse of controlled substances, particularly in opioid dependent patients. However, regulations prevent disclosure of opioid dependence diagnosis to prescribers. Because the program is based solely on prescription claims, there is a missed opportunity to identify patients with medical claims for methadone treatment. Abuse of medications may be reduced by requiring prescribers to utilize the Prescription Monitoring Program. Continued vigilance of claims data can be an avenue to manage remaining gaps in care.

6-032

Category: Chronic / Managed Care

Title: Evaluation of self-report medication adherence screening tools

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Purpose: Medication non-adherence is a serious issue in healthcare resulting in poor clinical outcomes and high costs. Although this is known, clinicians continue to struggle in improving medication adherence. The first step is to identify non-adherence patients and the second step is to provide an intervention in order to increase medication adherence. This abstract focuses on the first step. There are numerous tools available that assess adherence levels, MMAS-8 is most commonly used, and all have limitations. This abstract focuses on the evaluation and comparison of three existing self-report questionnaires for their ability to detect non-adherence: MARS, MMAS-8 and ProMAS.

Methods: This clinical observational study was conducted in 9 general practitioner outpatient offices within the UK (link trials.gov: NCT02115412). Eligible patients (>3 medications, between the age of 18-89) were invited to participate by the research. After acquiring written informed consent, patients filled out a screening instrument; including MARS (Horne & Weinman, 2002; 5-items with a 5-point answering scale, scores: 0-15, cut-off value: >1 non-adherent), MMAS is developed by Morisky (Morisky & DiMatteo, 2011; 8-items; 7 yes/no and 1 5-point answering scale, scores: 0-8, cut-off value: >1.75 non-adherent) and ProMAS (Kleppe et al. 2015; 19-items with a yes/no answering scale, scores 1-18, cut-off value: <=13 non-adherent). Selecting a reliable non-adherence risk screening tool will be based on various psychometric properties of the instruments. We will evaluate measures of reliability, skewness (asymmetry of a distribution) and kurtosis (how peaked the distribution curve is), and additionally estimate scale validity by comparing distributions to reported data.

Results: In total, 311 chronic patients completed the questionnaire. ProMAS has the highest reliability (α=0.81), compared to MARS (α=0.76) and MMAS-8 (α=0.60). MARS and MMAS-8 showed skewed distributions (z=5.23 and z=5.52, respectively). In contrast, ProMAS analyzed with the corresponding Rash method, did not show unskewed results (z=1.90) that better approximate adherence distributions obtained with objective measures (Sabate 2003). Furthermore, ProMAS did not have significant kurtosis (z=-0.5, p=0.60), while the MARS (z=3.3, p<0.01) and MMAS-8 (z=4.0, p<0.01) did. Finally, the MARS, MMAS-8 and ProMAS indicate different results in relation to the number of patients being adherent: MMAS-8 indicates that most patients are adherent (72% adherent, 28% non-adherent), MARS indicates that most

patients are non-adherent (31% adherent, 69% non-adherent) and, in line with what literature reports (Sabate 2003), ProMAS indicates that around half of the patients are non-adherent (54% adherent and 46% non-adherent).

Conclusion: MARS, MMAS and ProMAS indicated different representations of the same population. This means, that the result (whether a patient is classified as adherent or non-adherent) depends on the selected tool. An accurate screening tool could give clinicians a decision point on which patients need extra support to adhere to their medication regimen. Quality of the screening tool has a direct impact on which patients receive support and associated costs. The psychometric properties of ProMAS (compared to MARS and MMAS) are encouraging; however, further studies are needed to underpin its accuracy and effectiveness in stratifying a population for non-adherence interventions.

6-033

Category: Clinical Service Management

Title: The impact of an electronic system implementation on the number of pharmaceutical interventions

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Purpose: The use of electronic system in the hospital environment improves the quality of care and the safety of the hospitalized patient. The electronic system allows the access on patients drug therapy data and a quicker identification of eligible patients for the clinical pharmacist assessment. The objective of this study is to demonstrate the impact on the number of pharmaceutical interventions before and after the implementation of an electronic system that put in order of priority the hospitalized patients.

Methods: In 2012 an electronic system called Pharmaceutical Evolution System was developed and implemented.It classifies patients in order of priority to the clinical pharmacist assessment. The priority for assessment of the pharmacist is based on hospital internal protocols and criteria for risk of drug-related problems. Protocols and criteria are: renal dosing, drug interactions (quantity and severity), antimicrobial use (therapeutic and prophylactic), albumin indication, misoprostol indication, benzodiazepines time of administration, warfarin and intravenous heparin use, use of opioids, drugs with narrow therapeutic index, medication administration through enteral feeding tube and indication of carbapenems. The clinical pharmacist consulted the Pharmaceutical Evolution System daily and evaluated the patients according to priority order. All pharmacist interventions were registered in the system. Before the electronic system, the pharmacist evaluation was exclusively through active search.

Results: The department of pharmacy increased its clinical interventions from an average of 30.604 interventions / year (from 2009 to 2011) to 36.878 interventions / year after the electronic system implementation, from 2012 to 2014, this represents a 20.5% increase in the number of pharmaceutical interventions / year. Considering the number of patients / day, the average was 0.174 before and 0.193 interventions / patient / day after the electronic system implementation.

Conclusion: The use of an electronic system which classified the patients by priority order for clinical pharmacist assessment demonstrated to be beneficial, an increased on the number of pharmaceutical interventions was observed. In addition, by directing the eligible patients for

pharmaceutical assessment, the system allowed better management of the time spent by the clinical pharmacist.

6-034

Category: Clinical Service Management

Title: Clinical Pharmacist Rounding Model in a Community Hospital - Collaboration at its Best

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Purpose: The Pharmacy Practice Model Initiative encourages pharmacy to move away from centralized operational services to floor based direct patient care. This can be a challenge in a community hospital where physicians may all round at the same time or who prefer the non-academic model at most community hospitals. This initiative was designed to illustrate the value of pharmacists as part of the collaborative patient care team and implement a model of care that would optimize multi-disciplinary collaboration.

Methods: This organization has been supportive of clinical pharmacy care for decades. Historically, there have been few service line oriented clinical specialists. In 2012, a pilot was conducted to place pharmacists at the bedside with hospitalists and intensivists. Within 12 months, the pilot was disbanded with wavering support of hospital leadership and a need for pharmacists within the central operation. Financial data was analyzed reviewing the use of pharmacists before and after collaborative care. Literature evidence and story-telling was used to engage senior hospital leadership.

Results: Financially, patients with team-based care resulted in lower costs, although this could not be directly contributed to pharmacy. Examples of pharmacy cost savings encounters were also provided. Summaries of the evidence of pharmacist effectiveness were distributed. In 2013, pharmacy was approved for additional FTEs including those to accommodate back-filling of anticipated college faculty pharmacists. This initiative was solidified into practice that placed pharmacists on four hospitalist and 2 intensivist rounding teams. These pharmacists round 7 days a week with their physicians. Rounding was maintained with the Congestive Heart Treatment Center team, pediatric hospitalist, and surgical-trauma ventilator patients. Rounding also began with the infectious diseases physicians using the existing clinical specialist. Additional clinical staff does not round though continues to respond to pharmacy consults and proactively review patients on the acute care surgical and oncology service lines. The current physician practice models and workload volumes are limitations to rounding with these services.

Conclusion: Pharmacists with advanced training are vital to effective patient care team collaboration. Pharmacists at our organization are a critical component of the patient experience. Pharmacy is able to enhance the patient experience by facilitating medication information and ensuring core quality measures are addressed. The provision of evidence and story-telling can be an effective method to convincing senior leadership of the need for the expansion of pharmacy services at the bedside.

6-035

Category: Clinical Service Management

Title: Pharmacy communication process to ensure timely alteplase delivery

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Purpose: Patients who experience an ischemic stroke must meet a time constraint for eligibility of alteplase administration. According to 2013 ACC/AHA Guidelines for the early management of patients with acute ischemic stroke, the optimal door-to-needle time for administration of alteplase in ischemic stroke patients is less than 60 minutes from hospital arrival. A one hour time limit to access, diagnose, and prepare a medication can be a challenge when the hospital does not have an emergency department pharmacist. Our institution has implemented a procedure beginning when the patient arrives to the time of delivery to ensure a time efficient process.

Methods: The process implemented in this institution incorporates; nurses in the emergency department, pharmacy technicians, and pharmacist. A first call is made when a patient is admitted to the emergency department and a staff member calls the pharmacy. A pharmacy technician receives the phone call, pulls a Target Stroke form and fills in the appropriate information. The form is passed to the pharmacist with a prepackaged kit. The kit contains a dose calculation chart and other materials necessary for preparation of alteplase. The pharmacist calculates the appropriate dose per the Target Stroke form and calculation chart. Once the pharmacy receives a second call from the emergency department alerting the prescriber is ordering alteplase, a packaged kit is then used to mix the calculated dose for alteplase. This mixture is then verified and hand delivered to the emergency department for administration to the patient. The Target Stroke form includes information about the patient and times.

Results: From January to December 2014, 49 patients were identified as potentially having a stroke; therefore, a Target Stroke form was completed. The emergency department triage process deemed 32 patients ineligible for alteplase; therefore, 17 patients were administered alteplase. In 88.2% (n=15) of the cases, alteplase was prepared and delivered by the pharmacy department in less than 20 minutes.

Conclusion: Administering alteplase within a maximum of 4.5 hours is important to ensure the benefit outweighs the risk of use. In addition to the time limit set to use alteplase in patients who have experienced a stroke the 2013 ACC/AHA Guidelines also recommends a door-to-needle time should be within 60 minutes of arrival to the hospital. Our collaborative communication process between the emergency and pharmacy department has allowed our institution to meet

these standards. In addition to meeting the recommended door-to-needle time restraints, preparation of alteplase is overseen by a pharmacist and undergoes proper verification.

6-036

Category: Clinical Service Management

Title: Evaluation of the Accuracy of Medication Histories Performed by Pharmacy Personnel

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Purpose: Obtaining a medication history is an important part of the inpatient admission process. By accurately reconciling home medications, many drug-related problems will be avoided improving patient safety and avoiding unforeseen costs. Currently at UAB Highlands, nursing and medical staff are responsible for obtaining an accurate medication history on patients. The goal of this study is to demonstrate the difference in quality of medication histories performed by designated pharmacy personnel as compared to non-dedicated personnel on patients being admitted to UAB Highlands.

Methods: Select Pharmacy personnel were extensively trained in ways to properly obtain a medication history. Standardized data collection forms were completed that details any discrepancies that were observed. A dedicated medication history pharmacist then audited the data collection form and the rate of the findings were compared to that of non-dedicated personnel. Discrepancies were cross-referenced with the patient chart to determine if an error had occurred. The Standard of Care arm, Medication History Pharmacist arm, and APPE Pharmacy Student arm audits were compare to determine quality variance between the two groups. Data for the Standard of Care arm was collected in December of 2013 and there were 263 encounters in this group. Data from the Medication History Pharmacist arm was collected in February 2014 and there were 208 encounters within this group. Data from the APPE pharmacy student arm was collected from mid-January to mid-February 2015 and there were 176 encounters within this group.

Results: After analysis of the post audit data, we found that 76% of the medication histories collected by the Standard of Care contained at least one error compared to 12% in the Medication History Pharmacist arm and 15% in the APPE pharmacy student arm ($p<0.0001$, $p<0.0001$ respectively). We found no statistically significant difference between the pharmacist arm and the APPE pharmacy student arm ($p=0.294$). We also found that both the medication history pharmacist and APPE pharmacy student found at least one discrepancy in the previously documented medication history in 96% of the medication histories collected (96.2%, 96.1%; $p=0.965$). No correlation was found between the incorporation of dedicated pharmacy personnel and the rates readmission at UAB Highlands hospital.

Conclusion: We were able to demonstrates that dedicated pharmacy personnel are able to obtain medication histories with more accuracy than the current standard of care. We also demonstrated that APPE fourth year pharmacy students are able to obtain medication histories with as much accuracy and efficacy as a medication history pharmacist.

6-037

Category: Clinical Service Management

Title: Admission medication history: evaluation of preferred setting

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Purpose: Obtaining an accurate admission medication history is essential in ensuring optimal admission orders, hospitalization and discharge. Studies done previously at this inpatient institution demonstrated that medication histories, conducted primarily by nurses and emergency department technicians, were suboptimal. Most pharmacy-provided medication histories were being completed on inpatient units, after patient admission to the hospital; relatively few were completed by emergency department (ED) pharmacists. A cursory observation was made that pharmacy-provided medication histories conducted in the ED seemed more efficient. Therefore, the purpose of this review was to evaluate differences between medication histories conducted by pharmacy in the ED versus inpatient setting.

Methods: Interdisciplinary meetings were convened to delineate the steps in the inpatient and ED processes, respectively: processes were compared, process flow was evaluated, and opportunities for streamlining and optimization were identified. In order to facilitate a more comprehensive analysis, the documentation produced by a sole pharmacy resident who completed consecutive medication histories on adult inpatient units during one rotation, and then completed consecutive medication histories in ED while on rotation there, was retrospectively compared; the resident had collaborated with pharmacy students in both settings. The retrospective comparison included patients who were 18 years or older, with at least one targeted chronic disease. To better align comparison, the inpatient setting only included patients who had been admitted to general medicine units and the ED setting only included those who were eventually admitted to a general medicine unit; none of the patients had been admitted to critical care. For each setting, patient demographics, co-morbidities and number of medications, both scheduled and as needed, were tallied. Timing of the medication history, when performed on the inpatient unit, was documented. Also, number and type of discrepancies and interventions, including order changes, made by the pharmacy resident were reviewed and tabulated.

Results: The process improvement meetings demonstrated ED workflow to be more streamlined: fewer steps, less complexity and reduced redundancy. Opportunities for improvement were identified in both settings, with more identified for the inpatient setting. Analysis and discussion revealed that handling medication history discrepancies in the inpatient setting was cumbersome because orders, already administered to patients, had to be corrected;

the appropriate prescriber had to be identified, then was relatively difficult to contact and family was less likely available for assistance. Pharmacy documentation for 56 patients in the inpatient setting and 34 patients in the ED setting (who were subsequently admitted) was reviewed. Averages were compared for the inpatient and ED settings: number of chronic conditions was 4.7 versus 4.4; age was 54.4 versus 53.0 years; number of routine home medications was 6.9 versus 7.5. Average number of medication history discrepancies per patient was comparable: 2.1 versus 2.2. Medication histories completed in the inpatient setting, were completed on average 1.8 days after hospital admission; this delay contrasts with the timeliness of the ED setting. Further, medication histories performed in the inpatient setting identified 20 patients, of 56, whose inpatient orders were corrected based on the medication history completed by the pharmacy resident.

Conclusion: Pharmacy-provided medication history is less complicated and more efficient if completed in the ED versus the inpatient setting. Observationally, nursing and physician time is spared; further of benefit to other professionals is assurance of an optimal medication history. Additionally, the pharmacist can address potential issues prior to admission: targeting ED as the preferred setting for medication history facilitates best possible admission orders. Acknowledgment of logistical constraints is critical to effective staff deployment. Given resource limitations, allocation of pharmacy resources to conduct medication history should focus on ED, wherein efficiency and admission order appropriateness are both optimized.

6-038

Category: Critical Care

Title: Evaluation of implementing a guideline for the assessment and treatment of pain, agitation, and delirium in mechanically ventilated patients in the critical care unit

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Purpose: In 2013, the American College of Critical Care Medicine (ACCM) published updated guidelines on the management of pain, agitation, and delirium (PAD) in adult intensive care unit patients. Our institution formed a multidisciplinary team of physicians, pharmacist, nurses, respiratory therapists, and physical therapists to develop an institution-specific guideline which incorporated the new ACCM recommendations. This study evaluates the effects of implementing a PAD guideline in our 14-bed adult critical care unit (CCU).

Methods: In January 2014, an institution-specific PAD guideline was developed and approved by the Critical Care Committee and the Pharmacy and Therapeutics Committee. Starting in February, CCU physicians and nurses were educated on the new guideline and its recommendations. An electronic order set was created in the computerized physician order management system in August to facilitate compliance with the guideline recommendations. Nurses began using the CPOT scale for pain assessment and CAM-ICU for delirium screening in mechanically ventilated patients. Daily awakening and spontaneous breathing trials were implemented in all patients who met the guideline criteria. To evaluate the effects of implementing the PAD guideline, we conducted a retrospective electronic chart review which included all patients admitted to the CCU and mechanically ventilated for at least two days. Pre- and post-implementation data was collected from August 2013 through November 2013 and August 2014 through November 2014, respectively. Data assessed included the utilization of continuous intravenous infusions of analgesic and sedative agents, duration of mechanical ventilation, and CCU length of stay.

Results: A total of 136 patients were included in the analysis, 78 patients in the pre-implementation group (pre) and 58 patients in the post-implementation group (post). Midazolam infusion utilization decreased significantly from 38.5% of patients receiving infusion pre to 17.2% post (p=0.01). Propofol infusion utilization increased from 69.2% of patients receiving infusion pre to 79.3% post (p=0.19). There was a non-significant decrease in the days of continuous infusion of midazolam (4.6 days vs. 3.4 days, p=0.1), propofol (4.4 days vs. 3.8 days, p=0.14), dexmedetomidine (2.8 days vs. 2.4 days, p=0.18), and fentanyl infusions (5 days vs. 4.1 days, p=0.14). Compared with the pre group, there was no difference in the utilization of

dexmedetomidine and fentanyl infusions in the post group. The mean duration of mechanical ventilation was 6.2 days pre and 4.9 days post ($p=0.06$). The mean length of CCU stay was 7.7 days pre and 6.6 days post ($p=0.07$).

Conclusion: Implementation of the PAD guideline led to a significant decrease in the utilization of midazolam infusions for sedation and a trend towards increased use of propofol. Although not statistically significant, there was a trend towards reduced duration of continuous infusions of analgesic and sedative agents and reduced duration of mechanical ventilation and CCU length of stay.

6-039

Category: Critical Care

Title: The Incidence of Heparin Associated Bleeding at College Medical Center

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Purpose: College Medical Center (CMC) is a 184-bed hospital which provides medical-surgical and behavioral-health services. Heparin is widely used as an anticoagulant for treating acute thromboembolism and myocardial infarction and dosed by pharmacists under protocol at CMC. According to Chest 2012, aPTT and anti-Xa assays vary in their responsiveness to heparin. Currently, there is no benchmark to measure the incidence of heparin-associated bleeding. Therefore, it should be assessed periodically to prevent patient harm. The goals of this study are to determine if major bleeding at CMC was different from established studies and identify the high-risk population for heparin-associated bleeding.

Methods: A retrospective cohort-study was conducted in 102 patients to evaluate the incidence of heparin-associated major bleeding at CMC from 2012 to 2014. The inclusion/exclusion criteria and definition of bleeding were based on 9 studies (CHEST, 2004). A Chi-square test was used to compare incidence of major bleeding at CMC with incidence from established studies. An exploratory t-test and chart-review were conducted to reveal any high-risk populations or potential underlying causes for major bleeding.

Results: The average incidence of heparin-associated major bleeding from 9 established studies was 1.54%. The lowest and highest incidence ranged from 0.5% to 5.0%. Heparin-associated major bleeding at CMC was observed in 11 (10.78%) out of 102 patients [$X^2(1, N=102)=49.11$, $p<0.0001$]. No statistically significant association was found for age, duration of therapy, peak-aPTT, and baseline hemoglobin ($p > 0.05$). One of 11 major-bleeders was dosed with heparin aggressively. While outside data suggests that higher a body mass index (BMI) is likely to yield a higher aPTT (Bauer, 2009), there was a poor correlation between peak-aPTT and BMI ($R = 0.0008$) in the data collected.

Conclusion: Higher incidence of heparin-associated major bleeding was found at CMC and trends for high-risk populations in major bleeders could not be established. Heparin dosing was unlikely to cause major bleeding. A poor correlation between aPTT and BMI may warrant further investigation on the underlying cause. Although no concrete recommendations can be made at this time, this data and methodology can be abstracted as a framework for future benchmarking.

6-040

Category: Critical Care

Title: Inhaled milrinone in a cardiac surgical patient with pulmonary hypertension; a case report

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Case Report: Studies have shown that mean pulmonary artery pressure (mPAP) greater than or equal to 25 or greater than 30 mm Hg is a useful predictor of perioperative morbidity, mortality, and ICU length of stay in cardiac surgery patients. Pharmacological agents studied for use in pulmonary artery hypertension (PAH) include: inhaled prostacyclin, nitric oxide and intravenous (IV) vasodilators such as prostacyclin, nitroglycerin, nitroprusside, milrinone, and dobutamine. Milrinone, has been shown to reduce pulmonary artery pressures and augment right ventricular (RV) function in patients with pulmonary vascular dysfunction. Studies have suggested that milrinone may be beneficial in the treatment of pulmonary hypertension in cardiac surgery. However, IV milrinone can be associated with systemic hypotension and increased vasoactive drug requirements. Inhaled milrinone (iMil) has been described in several small studies and case reports as an alternative to allow targeted drug delivery aiming towards high local concentrations with less systemic hypotension. We describe the case of a 26 year old female admitted with severe hypotension due to cardiogenic shock and pulmonary edema. Her condition was complicated by shock liver and acute kidney injury requiring intubation and mechanical ventilation. She was started on norepinephrine, epinephrine, dobutamine and vasopressin for hemodynamic stabilization. Transesophageal echo upon admission showed the following: a flattened septum due to RV pressure overload, tricuspid annual plan systolic excursion (TAPSE) of 0.9 mm, mPAP 61 mm Hg, LVEF of 55 percent, severe mitral stenosis, severely impaired RV systolic function, severely dilated right and left atrium and severe tricuspid regurgitation. No evidence of pneumonia or pulmonary embolism was noted. Upon day 2 of admission, her inotropic requirements were norepinephrine 0.2 mcg/kg/min, epinephrine 0.1 mcg/kg/min, vasopressin 0.02 units/min, dobutamine 10 mcg/kg/min and Levosimendan 0.1mcg/kg/min. Her vitals were: BP 105/60 mm Hg, HR 110/bpm in atrial fibrillation, FiO2 of 35 percent and mPAP of 58 mm Hg as per transthoracic echo (TTE). Patient was then started on epoprostenol at the dose of 2ng/kg/min titrated to 16ng/kg/min based on the estimated mPAP. On day 3, her condition minimally improved. IV milrinone started could not be titrated further due to progressive hypotension. The patients mPAP did not respond to increasing doses of IV milrinone and IV epoprostenol requiring inhaled nitric oxide (NO) at 20 ppm. A pulmonary catheter was then placed and the patient was started on iMil as a last resort for worsening pulmonary pressures and decreasing hemodynamic stability. iMil was administered continuously through the ventilator circuit in addition to NO via a nebulizer. iMil was reconstituted from a 1-mg/ml vial of intravenous solution with normal saline to a final concentration of 0.4mg/ml. Nebulizer was expected to deliver 4 mg/h of solution continuously at a flow rate of 10ml/hr. Patients initial

response to inhaled milrinone was dramatic with a drop of the mPAP down to 50 mm Hg after 4 hours and no effect on other hemodynamic parameters. 24 hours later inhaled milrinone was continued with dobutamine and epoprostenol at 6ng/kg/min with further reduction in mPAP to 49 mm Hg. The combination was continued with further decrease in epoprostenol to 3ng/kg/min until surgery 3 days later. On the day of surgery the measured hemodynamics recorded by pulmonary artery catheter and TTE include mPAP of 35 mm Hg, TAPSE 1.4 cm and EF 55%. Following mitral valve replacement and tricuspid valve repair patient was hemodynamically stable with fair post-operative course. We conclude that the iMil can be an effective treatment of secondary PAH in high-risk cardiac surgery patients. The exact indications for inhaled milrinone usage, optimal concentrations for this route, and the beginning and duration of treatment are yet to be confirmed by further studies.

6-041

Category: Critical Care

Title: Evaluation of the appropriateness of gastrointestinal prophylaxis in the critically ill

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Purpose: Gastrointestinal (GI) bleeding resulting from stress ulceration is one complication that can arise in critically ill patients. The use of acid suppression therapy for stress ulcer prophylaxis has become routine in the Intensive Care Unit (ICU) as an effective prevention strategy against stress-related mucosal disease (SRMD). While SRMD can double the length of an ICU stay, inappropriate continuation of prophylaxis in patients can also contribute to Clostridium difficile and hospital-acquired pneumonia (HAP). The objective of this study was to determine the utilization of SRMD prophylaxis in the ICU of a large teaching institution based on duration and defined adverse effects.

Methods: This retrospective medical chart review was approved by the Institutional Review Board. Patients were included if they were greater than or equal to 18 years of age and received pantoprazole, lansoprazole, famotidine, or sucralfate for stress ulcer prophylaxis in the ICU within the period of May 1, 2013 and July 31, 2014. Patients who received an organ transplant within the last year or had an active GI bleed were excluded. A randomized list of 150 patients meeting the inclusion criteria was compiled for review. Patients were reviewed for appropriateness of SRMD prophylactic therapy based on the presence of two independent risk factors (coagulopathy and mechanical ventilation greater than 48 hours) versus the presence of any one risk factor from a list developed by the study investigator. Data was collected into spreadsheets and outcomes were analyzed using descriptive statistics.

Results: Of 150 randomized patients, 116 were included in the analysis. 53 percent received prophylactic therapy with famotidine, 63 percent with a proton pump inhibitor (PPI), and 14 percent with sucralfate. Notably, 32 patients received more than one agent during their length of stay. 68 percent of patients had either of the two independent risk factors present, while 32 percent did not. When evaluating based on the presence of any risk factor, 84 percent had at least one risk factor present, 16 percent did not have any. Patients whose therapy exceeded appropriate stop-date based upon the two independent risk factors versus the presence of any risk factor were 63 percent and 47 percent, respectively. For those who received famotidine, there was one occurrence of Clostridium difficile and 6 cases of electrolyte abnormalities. In patients who received a PPI, there was one case of HAP, two cases of ventilator-associated pneumonia (VAP), three cases of Clostridium difficile, and 14 patients who developed electrolyte abnormalities. In patients who developed HAP and VAP, the median duration of therapy was 26 and 21 days,

respectively. The median duration of therapy for those who developed Clostridium difficile and electrolyte abnormalities was 9.5 and 15 days, respectively.

Conclusion: Data does not show an association between acid suppression therapy and incidence of nosocomial infections. The number of patients whose therapy exceeded appropriate stop-date compared with the number of patients in which SRMD prophylaxis was discontinued when risk factors diminished was greater when evaluating patients based upon the two independent risk factors. Further studies need to be conducted to evaluate patients with a longer length of stay, extending to general medicine floors.

6-042

Category: Critical Care

Title: Emerging challenge to clinicians: multidrug resistant acinetobacter baumannii in Lebanese university hospitals

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Purpose: Multidrug resistant Acinetobacter baumannii (MDR AB), a highly emerging and threatening bacterium, has become a worry to the majority of patients who are admitted to the intensive care wards in Lebanese hospitals. Our aim is to determine the frequency and percentage of mortality in patients infected with MDR AB in critical care units. Moreover, an identification of the risk factors and an evaluation as to whether the antibiotics are given according to culture susceptibility results, with correct doses and duration, have been carried out.

Methods: This study was designed as a retrospective observational study in three Lebanese university hospitals after obtaining the approval of the institutional review board of the Lebanese International University. A clinical data collection form was developed and validated. The pharmD candidate collected data from the medical charts for adult patients infected with MDR AB, who have been admitted to the critical care units during the time frame between January 2014 and March 2015. The information that was gathered included the demographic characteristics of patients, co-morbidities, risk factors, infection types, culture sites and susceptibility analysis, antibiotics administered, including the dose, duration of therapy, length of hospital stay (LOHS), and the final outcome, as to whether the patient died during the stay or was discharged. Data was analyzed by the software package used for statistical analysis (SPSS) version 21.0, and presented as frequency/percentage, means, and standard deviations (SD). A pearson chi square p-value of less than 0.05 was considered to indicate statistical significance.

Results: Survey data was analyzed based on 307 patients, from whom 370 positive culture isolates were recovered. The average age was 66.5 years (SD 17.96). Culture sites included: respiratory tract 61 percent, wounds 16 percent, blood 14.6 percent, urine 4.6 percent, intravenous catheter 3.5 percent, and cerebrospinal fluid 0.27 percent. During the hospital stay, 205 (66.8 percent) were deceased: within 15 days (74.4 percent), 30 days (18.1 percent), and 3 months (7.5 percent). Risk factors included prolonged LOHS above 14 days, immunocompromized, chronic pulmonary disease, mechanically ventilated, intubated, surgery, recent antibiotics, foley and central catheter in 44, 18, 18.9, 85.3, 64.7, 27.2, 90.2, 78.4, and 38.8 percent respectively. Susceptibility tests resulted in resistance to most antibiotics, while 66.8 and 99.7 percent were sensitive to tigecycline and colistin respectively. Colistin was used as monotherapy or combined with tigecycline or rifampin (average duration 10.29 days, SD 7.053) with no significant difference in mortality (p-value more than 0.05). The antibiotics were given

according to: susceptibility 85.66 percent and appropriate dose or duration 57.5 percent. The infection prolonged the length of the hospital stay by 15.9 days (SD 16.42). Death was blamed to the infection in 59.4 percent of the dead patients.

Conclusion: This study indicates that mortality among MDR AB infected individuals in the critical care wards at Lebanese hospitals poses a formidable threat to patients. This is likely as a result of the inappropriate management of the infection, the virulence of MDR AB itself, and the co-morbid conditions the hosts present with. Given the attributable mortality and restricted antibiotic options, clinical pharmacists and health care professionals have a key role in enhancing surveillance for these organisms at unit-specific, institutional, and national levels.

6-043

Category: Drug Information

Title: Level of Evidence Associated with FDA Safety Communications with Drug Labeling Changes: 2010-2014

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Purpose: Approximately 800,000 safety reports are submitted to the FDA annually, however, only significant issues generate drug safety communications. The FDAs drug safety communications provide information including (i.e., serious adverse effects, medication errors, market removal). However, the level of clinical evidence is not standardized for each event and can vary from a single adverse event report to controlled clinical trials. The purpose of this retrospective study was to determine the type of clinical evidence used to warrant a change in drug labeling for drugs that had FDA safety communications between January 1, 2011 to December 31, 2014.

Methods: Selected data was obtained from the Medical Product Safety Information section of the FDA website (http://www.fda.gov/Safety/MedWatch/SafetyInformation/default.htm). The data was manually evaluated to include the following information: the date of the safety communication; the drug or drug class involved; the type of label change (e.g., boxed warnings, adverse reactions, pregnancy category); the level of evidence (LOE), based on the criteria that was determined from the American College of Cardiology and American Heart Association (ACC/AHA) guidelines4; type of study/evidence listed in the communication; publication status of the evidence; and if the safety communication was ongoing. Level of evidence (LOE) was determined by ACC/AHA guidelines and was classified by Levels A C. If more than one type of evidence was cited for safety communication, the highest level of evidence was documented. The primary endpoint of the study was the frequency of the types of clinical evidence used in FDA communications during the time frame above, as reported through the FDA drug safety communications. Secondary endpoints were the type of drug labeling changes (e.g. boxed warning, precautions, adverse events, pregnancy category, etc). Results were evaluated via SPSS (version 19). Descriptive statistics, chi-squared for nominal data, and ANOVA for continuous data were analyzed.

Results: A total of 2521 drug safety labeling changes were identified and 99 (3.9 percent) of safety communications met the inclusion criteria. The majority of the labeling changes were associated with single agents (83.8%). The largest number of labeling changes occurred in 2011 (33.3%) followed by 2010 (20.2 percent), 2012/2013 (18.2 percent), and 2014 (8.1 percent). The

three most frequently reported labeling changes were warnings (68.7 percent), precautions (58.6 percent), and patient and patient package insert/medication guide (23.2 percent). Case reports resulted in the greatest number of documented literature types (n equals 791), followed by randomized controlled trials (n equals 76), and case control/cohort studies (n equals 74). Significantly more reports were classified as LOE B (68.6 percent), followed by LOE A (17.1 percent), and LOE C (14.1 percent) (p equals 0.007). AHFS classes most frequently identified were CNS drugs (21.2 percent), anti-infective agents (18.2 percent), and immunosuppressant agents (8.1 percent). No significant differences in LOE and labeling changes were observed for any category. Significantly fewer drug-drug interactions were published compared to other labeling changes (p equals 0.048).

Conclusion: Limited drug experience is available when a drug product is approved by the FDA. Therefore, postmarketing studies and adverse event reporting systems are in place to help practitioners understand clinically significant changes in a drugs benefit to risk profile. However, only a fraction of drug safety changes result in a FDA communication. Warnings were responsible for the majority of the labeling changes. The majority of labeling changes in this study were associated with LOE equivalent to B (e.g., cohort studies). Practitioners should evaluate data associated with labeling changes to ensure that optimal patient care is maintained.

6-044

Category: Drug Information

Title: Interprofessional curbside consults to improve student drug information skills and achievement of learning outcomes

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Purpose: In response to feedback from preceptors on students' ability to respond to drug information requests from non-pharmacist clinicians and on the need for increased curricular exposure to develop competencies related to interprofessional education, we sought to design, implement and evaluate the Interprofessional Curbside Consult (ICC) assignment in a P3 required skills lab course.

Methods: Prior to lab, students listened to a 20-minute didactic lecture on the Situation-Background-Assessment-Recommendation (SBAR) communication framework and viewed short videos describing the roles, responsibilities and typical work settings of 4 health care professions: dentist, physical therapist, nurse and nurse practitioner. During each of 4 labs, students rotated through simulated interactions with 4 different clinicians (as role-played by a lab instructors). Each time, the clinician asked a unique drug information question and responded to any clarifying questions from the student. Students had 30 minutes to find the information and return to the room to verbally respond. Documentation of the response on a standard drug information request form was submitted for grading. Performance was assessed using a 3-part rubric (receiving the question, verbal answer, written documentation). Feedback on the student's ability to provide accurate drug information tailored for a particular profession was also provided. Impact of the assignment was assessed by a pre-/post-survey, review of student grades, and performance on 4 Center for the Advancement of Pharmacy Education (CAPE) outcomes addressed by the assignment. The survey included the validated TeamSTEPPS Teamwork Attitudes Questionnaire as well as knowledge assessment items related to the 4 health professions.

Results: One hundred thirty students were enrolled in the skills lab course in spring 2015. Matched pre and post survey data was available for 113 students (87%). Survey results revealed positive attitudes towards team-delivered care at baseline, with statistically significant improvement on 17 out of 30 items ($p<0.05$, Related Samples Wicoxon Signed Rank test) after the ICC assignment. Particularly, attitudes significantly improved on two items related to communication: "I prefer to work with team members who ask questions about information I provide" and "It is important to have a standardized method for sharing information when handing off patients." Mean score on all 4 ICC assignments was 86% with scores ranging from 87% on the first to 90% on the last. The ICC assignments covered 4 CAPE competencies including communicator, educator, interprofessional collaborator and problem solver.

Comparing pre- and post-ICC results, the mean performance on items mapped to these competencies improved for the problem solver and collaborator competencies, remained the same for the communicator competency and decreased on the educator competency. For the educator competency, expectations for student performance may have been unachievable and should be examined prior to the next offering.

Conclusion: Overall the assignment was well received, successful and will be continued in future years. The ICCs provided additional opportunities for students to practice responding to drug information questions from non-pharmacist clinicians and improved problem solving and interprofessional collaboration competencies. Over the next year, students from other health professions will be integrated into this simulation.

6-045

Category: Drug Information

Title: Comparison of drug label information on pregnancy of new molecular entities (NMEs) approved between 2008 and 2013 in Korea, the USA, the UK, and Japan

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Purpose: Medication use during pregnancy is common. Due to the potential risk and often unknown fetal effects, drug use during pregnancy requires a careful strategy. Label information is a crucial source of information for both healthcare professionals and consumers. This study compared the label information of 31 new molecular entities (NMEs) approved drugs in Korea, the USA, the UK, and Japan.

Methods: The study drugs were selected based on the recently approved NMEs list provided by Korea Ministry of Food and Drug Safety (MFDS) from January 1st, 2008 to September 30th, 2013. Among the list of drugs, products approved and available in all four countries were selected. The total of 31 drugs was selected as study drugs. We compared the label information related to pregnancy of four countries by searching each label and categorizing its evidence and recommendation level. Evidence level was divided into five categories, Definite, Probable, Possible, Unlikely, and Unclassified. Recommendation level was divided into four categories, Contraindicated, Caution, Compatible, and Unclassified. We calculated the frequency and percentage for each category of evidence level and recommendation level. Statistical significance was assessed using the Chi-square test or Fishers exact test with Bonferroni correction. We also calculated the percent agreement and kappa coefficient with 95% confidence interval (CI). For all statistical analysis SAS ver. 9.3 was used and p-value < 0.05 was regarded as statistically significant.

Results: Among 31 study drugs, the majority of the evidence was classified into possible or unlikely, which indicate that the evidences were based on animal studies. Approximately 55% of the evidence levels of the USA and UK were unlikely. The unlikely comprised the most of the label of Korea, the USA, and UK. The evidence level of Japanese labels was mostly unclassified (54.8%) showing the lack of information on clinical or animal studies in product labels. The recommendation level of caution represented the most and none were compatible in all four countries. About 90.3% of the US labels were categorized into caution and the remaining 9.7% were unclassified. Unlike the lack of contraindicated designation in the US labels, the labels of Korea, the UK, and Japan included 22.6%, 29.0%, and 16.1% of contraindicated respectively. The percent agreement of evidence level was the highest between the USA and the UK (90.3%, kappa 0.84) and the percent agreement of recommendation level was the highest between Korea and the UK (93.5%, kappa 0.85).

Conclusion: The drug label information of pregnancy varied among four countries. Reliable safety information of new drugs in pregnant women should be provided for healthcare professionals and consumers through global standardization and regular updates.

6-046

Category: Drug Information

Title: Preference and frequency of mobile app use for drug information among student pharmacists

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Purpose: The use of mobile devices among health professionals for accessing drug information (DI) is increasing. While a variety of mobile applications (Apps) for such devices are available both freely and for purchase, the accuracy of DI and the extent to which student pharmacists use these Apps is unknown. This study investigated the preference and frequency of mobile DI App use among student pharmacists from three pharmacy schools.

Methods: Investigators from three pharmacy schools generated a 13-question survey relating to students demographics, type of mobile operating system (Apple or Android) owned, number and frequency of DI Apps used, whether the Apps were free or purchased, and perception about the accuracy of purchased versus free Apps, by using a list of top 20 DI Apps (based on number of downloads for each App from the App store). Survey questions were validated by two pharmacy faculty and two student pharmacists who are not involved in the research. Revisions were made to enhance the readability and interpretation of the survey questions. The final survey was electronically disseminated via SurveyMonkey to all current P1 through P4 students from all three pharmacy schools. Three reminder e-mails were sent through SurveyMonkey to all of the students who did not respond. To encourage participation, an online randomization tool was used to select five students to receive a 10-dollar gift card after the survey was closed. The research protocol and survey were approved by the institutional review boards of all three schools. Microsoft Excel 2013 and Stata 13.1 were used to analyze descriptive and statistical results with alpha less than 0.05.

Results: The survey was sent to 904 students of which 298 responded (33 percent response rate). The response rate was similar between all schools (35.6 vs. 33.9 vs. 30.5 percent; p=0.56). A majority of students were women (66 percent) and between the ages of 21-30 years (83 percent). Approximately 31 percent of students were in their final year of pharmacy school. There was no difference in using mobile devices between men and women (77.2 vs. 72.6 percent, respectively; p=0.6). Seventy-four percent of students reported using their mobile devices for finding DI (n = 221). Of these students, 76 percent used mobile devices for DI a few times a week or more. Ninety-four percent of students used between 1-3 Apps for DI; however, only 17 percent of them purchased Apps for finding DI. Ninety-six students reported using both free and purchased Apps for obtaining DI. Purchased Apps were perceived to be more accurate (61 percent), more comprehensive (79 percent), more up to date (57 percent), and easier to use (38 percent)

compared with free Apps, similarly between men and women (p=0.165). The three most frequently used Apps were Lexicomp (n=128, 57.9 percent), ePocrates (n=103, 46.6 percent), and Micromedex (n=79, 35.8 percent).

Conclusion: A majority of pharmacy students used 1-3 mobile Apps for finding DI, irrespective of their year in school or gender. A majority of students used free Apps available through their institutional subscription and only a minority of students purchased Apps for finding DI. A majority of students who used both free and purchased Apps perceived that the purchased Apps were more accurate, more comprehensive, and more up to date than the free Apps.

6-047

Category: Drug-Use Evaluation

Title: Efficacy of fluconazole prophylaxis for invasive fungal infecton in extremely low birth weight infants

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Purpose: Invasive fungal infection (IFI) is an important cause of morbidity and mortality in preterm infants with immature immune systems. We evaluated the efficacy in preventing IFI and adverse effects of prophylactic fluconazole inextremely low birth weight infants (ELBWIs).

Methods: A retrospective observational study was conducted in a total of 106 preterm infants birth weight less than 1kg hospitalized in neonatal intensive care unit (NICU) of Asan medical center from January 2010 to July 2012. In May 2011, unit policy on fluconazole prophylaxis had implemented (3 mg/kg twice a week intravenous infusion during the central or peripheral venous catheter insertion), and we had classified study population into two groups; control group (admitted before the introduction of fluconazole prophylaxis, n equals 71), and study group (admitted after the introduction of fluconazole prophylaxis, n equals 35). The incidence of IFI and the strains of infection were investigated, and other outcome variables including mortality and the occurrence frequency of adverse effects of fluconazole were also collected.

Results: The incidence of IFI was 2.9% in the study group versus 19.7% in the control group (p less than 0.05). Logistic regression revealed that fluconazole prophylaxis significantly decreased the rates of IFI (Odds ratio equals 0.082, p less than 0.05). There was no difference in incidence of cholestasis between two groups and there was no evidence of hepatotoxicity of fluconazole.

Conclusion: Prophylactic administration of fluconazole in ELBWIs revealed effective in preventing IFI without significant adverse effects.

6-048

Category: Drug-Use Evaluation

Title: Evaluation of the inpatient use of linezolid on the respiratory specialty care unit (RSCU) at the University of Iowa Hospitals and Clinics (UIHC)

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Purpose: Linezolid is generally regarded as an alternative to the mainstay therapy, vancomycin, for methicillin-resistant Staphylococcus aureus (MRSA) infections. UIHC criteria for linezolid use 1) recommended by Infectious Diseases, or 2) documented/suspected vancomycin resistant enterococci infection (VRE), or 3) documented/suspected MRSA infection refractory to vancomycin, or 4) documented/suspected MRSA and allergy/intolerance to vancomycin. The presence of an MIC creep for linezolid within the institution had recently been discovered. The objectives of this study were to evaluate the inpatient use of linezolid in the RSCU at UIHC and describe the influence of a vancomycin shortage.

Methods: This study was conducted at the University of Iowa Hospitals and Clinics, Iowa City, Iowa, using data from the hospital's electronic medical record system, Epic. The institutional review board approved this retrospective chart review of patients that received an inpatient administration of linezolid for the time period of March 1, 2014 to May 31, 2015 in RSCU. The hospital-wide broadcast regarding the vancomycin shortage was disseminated on October 16, 2014, for this reason, October 2014 was excluded from analysis. For the comparative analysis, the "before" study period (the 7 months before the vancomycin shortage, March 2014-September 2014) was compared to the "after" study period (the 7 months after the vancomycin shortage was announced, November 2014-May 2015).

Results: Results of this study demonstrated current utilization of linezolid on RSCU is suboptimal based on current protocol criteria. The chart review revealed 26 percent of courses met criteria for use. Although linezolid was administered to 65 patients, MRSA positive cultures were isolated 30 times; one VRE positive culture was isolated. Before the vancomycin shortage announcement, 41 percent of linezolid courses met criteria vs. 21 percent after. Concordance between prescriber indicated criteria vs. what was learned during MUE chart review in regards to both criteria for use and indication were low (overall 20 percent for criteria, 35 percent before vs. 15 percent after; overall 55 percent for indication, 82 percent before vs. 46 percent after). The majority of patients initiated linezolid therapy on RSCU (83 percent). The overall average length of linezolid therapy was 7.4 plus or minus 4.2 days with the length of therapy decreasing after the vancomycin shortage announcement (before, 9.3 plus or minus 4.0 days vs. after, 6.8 plus or

minus 4.0 days). Based on prescriber selected criteria and documentation in the medical record, red man syndrome and renal insufficiency may have been considered allergies/intolerances to vancomycin which may not be entirely accurate.

Conclusion: The results of this study provide evidence that current practice does not support optimal use of linezolid on the RSCU at UIHC based on protocol criteria. It appears that the vancomycin shortage decreased adherence to linezolid protocol criteria. Although linezolid resistance is rare, it may be increasing based on the appearance of a MIC creep for MRSA at our institution. An effort will be made to reinforce linezolid protocol criteria and to educate both pharmacists and prescribers on proper linezolid use.

6-049

Category: Drug-Use Evaluation

Title: Evaluation of total parenteral nutrition usage at a regional health system

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Purpose: The correct utilization of total parenteral nutrition (TPN) has an impact on cost, time utilization of health professionals, and patient outcomes. The number of patients being started on TPN was identified as an issue by the pharmacy team. A study in the New England Journal of medicine found that patients that received late initiation TPN, defined as 7 days after being unable to receive oral feeding, experienced better outcomes compared to those who were started earlier. This project was designed to identify trends in patients being initiated on TPN and where pharmacists can play a role in decreasing improper usage.

Methods: A retrospective review of all orders for total parenteral nutrition from July 1st, 2014 to February 28th, 2015. The data included patient information including age and gender along with hospital information including admission date, hospital, unit, and discharge date. From that information the time from admission to total parenteral nutrition initiation was determined along with time from TPN completion to discharge date. The data was compiled to show trends of age, gender, time on TPN, and time to initiation of TPN. It was also broken down by each hospital in the health system.

Results: The study found 1910 orders for total parenteral nutrition for 213 patients during our study period. The analysis showed that 38% of patients were started on TPN 7 days or more after admission. The median number of days from admission to TPN initiation was 5 days. Further evaluation showed that 48% of patients received TPN for longer than 7 days. The study also showed trends that more women received TPN and patients ages 70 and older accounted for 46% of the TPN orders used. The breakdown of data also showed that these trends mostly held constant for each individual hospital. Surgical and intensive care floors were where a majority of the TPNs were initiated.

Conclusion: A retrospective review was beneficial in showing trends and areas where the pharmacy staff can help decrease improper use of total parenteral nutrition. Keeping this study in mind, pharmacists can be more aware of the data presented about outcomes related to TPN usage and ensure the appropriate steps are taken prior to starting TPN. This data can be shared with other medical professionals to help educate on the approved uses for TPN.

6-050

Category: Drug-Use Evaluation

Title: Restricted use of rifaximin for overt hepatic encephalopathy in a county health system

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Purpose: Hepatic encephalopathy (HE) is the primary reason for hospitalization of patients with liver cirrhosis, the cost associated with this is around $932 million nationwide. In a county health-system, rifaximin was placed on a prior-authorization program (PAP) primarily due to its high cost. It is restricted to patients with overt hepatic encephalopathy that must meet criteria approved by the Pharmacy & Therapeutics Committee and Medical Board. The purpose of this evaluation is to assess the frequency, usage and compliance of rifaximin with the pre-authorization guidelines.

Methods: A retrospective electronic chart review was conducted on all patients receiving rifaximin from December 2010 to September 2013. The report characteristics included the patients demographics, diagnosis, number of HE episodes, documented overt HE while receiving first dose, documented failure of lactulose, lactulose dose if used, dose and duration of use of rifaximin, number of hospital admissions post first dose, and documented prior authorization. Patients receiving rifaximin for any other indications outside of hepatic encephalopathy were excluded. The prior-authorization criteria for use are as follows, patients with overt HE with at least one episode within the prior six months and a current admission for overt HE as well as documented failure of lactulose. Patients must be reevaluated every 3 months to continue therapy. Patients who do not meet the criteria are referred to a designated on-call physician who can override any of the set guidelines. Non-compliance is defined as the absence of documented prior-approval and or any of the PAP criteria as verified through chart review.

Results: Ninety-nine patients were reviewed, sixty-five percent (65/99) were males and thirty-five percent (35/99) were females. The average age of the patients was 52 years of age. Ninety-four percent (93/99) had documented diagnoses of hepatic encephalopathy and six percent (6/99) had a documented diagnosis of intestinal bacteria overgrowth. Ninety-three patients were included in the analysis and six patients were excluded due to diagnosis. Sixty-one percent (57/93) were inpatient and thirty-nine percent (36/93) were outpatient. With regards to episodes of HE, twenty percent (19/93) of the patients had two or less episodes in the past 12 months. Forty-five percent (42/93) met the criteria for having one episode in the past 6 months and sixty-one percent (57/93) had a current admission for overt hepatic encephalopathy with the first dose of rifaximin. Only thirty percent (28/93) of the patients had a documented failure or intolerance to lactulose. Twenty-seven percent (25/93) had at least one admission post rifaximin use

involving hepatic encephalopathy. Nineteen percent (18/93) of the patients used rifaximin greater than 3 months. Fifty-nine percent (55/93) of the patients had documented prior approval.

Conclusion: The analysis revealed that there was low compliance in regards to prior approvals as well as adherence to the prior authorization criteria. It was proposed that the increasing cost associated with rifaximin use may be due to patients with multiple readmissions. A follow up review was conducted of the patients who had greater than 2 admissions post rifaximin use involving hepatic encephalopathy. The theory was disproved, only one patient to date had 2 additional admissions. The medical staff and pharmacist were reminded of the importance of following the restriction guidelines in an effort to control cost.

6-051

Category: Drug-Use Evaluation

Title: Evaluation of 17- Hydroxyprogesterone use in the prevention of preterm births in a county health-system

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Purpose: Preterm births can lead to long term and severe disorders in children; it is when an infant is born less than 37 weeks of pregnancy. 17- Hydroxyprogesterone caproate (17- OHP) is a hormone indicated for the prevention of pre-term labor for a singleton pregnancy. There was an unexpected increase in the cost of 17- OHP in a county health-system placing it in the top expenditures. This became a major concern considering the budgetary limitations that a county hospital often faces. The purpose of the evaluation is to assess the appropriate use and frequency of 17- OHP in a county health-system.

Methods: A retrospective electronic chart review was conducted of 100 female patients receiving 17-OHP for prevention of preterm delivery from December 2012 through May 2013. Patients receiving 17-OHP for any other indication were excluded. The 17-OHP injections must start from 16 weeks 0 days to 20 weeks and 6 days gestation and stop at 36 weeks 6 days or labor whichever comes first. The data collected included, patients demographics, location of service, documented history of pre-term labor for singleton or multiple gestation, medication start date, number of injections given, number of injections prescribed, adverse events, adherence, and documentation of history of pre-term labor/delivery.

Results: The average age of the one hundred female patients reviewed was thirty-one years of age. All 100 patients had an indication of pre-term labor. Ninety-eight percent (98/100) of the patients had a singleton gestation and two percent (2/100) of the patients had multiple gestations (twins), one patient stopped the injections due to lack of indication. Eighty-two percent (82/100) of patients started within the recommended window of 16 to 20 weeks. Only twenty-one percent (21/100) completed their prescribed number of injections. Some injections were stopped early due to miscarriage (1%), short cervix (1%), multiple gestation (1%) or delivery prior to completion of prescribed injections. Twenty-seven percent (27/100) of the patients had pre-term labor while receiving 17-OHP injections. Four of them were compliant with the injections while twenty-three did not complete the prescribed injections. The reasons for not completing the injections was not noted their chart. The average delivery date was 36 weeks, ranging from 22 weeks to 40 weeks. There was no distinct correlation between late start versus early start on preterm delivery.

Conclusion: Eighty-nine percent of the patients did not complete there prescribed number of injections. An entity under the same umbrella as the county health-system addressed this issue by sending a nurse to the homes of the patients who were to receive 17-OHP injections in an effort to increase compliance. The county health system spent over 800,000 dollars in one year on 17-OHP, although a budget buster it is much less than the cost of the long term care of a child as a result of a preterm birth.

6-052

Category: Drug-Use Evaluation

Title: Review of clinical outcomes for hip and knee arthroplasty patients receiving liposomal bupivacaine

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Purpose: Liposomal bupivacaine is a non-opioid pain treatment approach increasingly used by orthopedic surgeons after hip and knee arthroplasty. The purpose of this project was to evaluate the utility of this drug in our local population at a 250 bed non-profit community hospital. To do this, we conducted a retrospective review of all patients undergoing primary hip and knee arthroplasty at our institution from July 1, 2013 to January 1, 2014. This project was reviewed by our local Institutional Review Board and categorized as quality improvement.

Methods: The primary outcome was length of hospitalization after surgery. Secondary outcomes included average postoperative opioid use per day, postoperative pain control (taken from 0 to 10 scale, as average pain score per day), and a subset analysis of average ambulation distance during physical therapy after surgery among knee arthroplasty patients for three high-volume surgeons. Several other characteristics were gathered for use as controls so as to minimize the risk of confounding, including: procedure, gender, age, surgeon, other non-opioid analgesic use, and discharge disposition. All data were obtained from electronic medical records. Length of stay was analyzed using the Cox Proportional Hazard model and the secondary outcomes were analyzed using multivariate linear regression. In preliminary univariate analyses, surgeon was determined to be strongly associated with outcomes. As a result, the final analyses accounted for this by examining outcomes within each surgeon's strata through the use of an interaction term between surgeon and treatment group in the statistical model.

Results: Three hundred thirty patients met the criteria for inclusion in the cohort, of which 28 percent overall received liposomal bupivacaine during surgery. Among 187 knee arthroplasty patients, 20 percent received liposomal bupivacaine, and among 143 hip arthroplasty patients, 39 percent received liposomal bupivacaine. Using multivariate analysis, there was no significant association between liposomal bupivacaine use and length of stay. There was also no significant association between liposomal bupivacaine use and average daily postoperative opioid use among most patients. One surgeon's patients, though, had an excess of 2.9 milligrams per day of intravenous morphine equivalent associated with the use of liposomal bupivacaine, which trended toward statistical significance (p equals 0.08 for interaction term). Liposomal bupivacaine use was not associated with a difference in average daily pain score within 24 or 48 hours after surgery. In the subgroup analysis of ambulation, there was no consistent association

between liposomal bupivacaine use and ambulation distance within 24 or 48 hours after surgery. However, liposomal bupivacaine use was associated with a significant reduction in ambulation distance of 184 feet per day among one surgeon's patients (p equals 0.03 for interaction term).

Conclusion: Overall, the use of liposomal bupivacaine was not associated with differences in patient outcomes after primary hip or knee arthroplasty as assessed by length of stay, postoperative opioid use, postoperative pain score, and postoperative ambulation. Unmeasured variation in surgeon practice and other covariates appeared to be the main contributor to differences in outcomes with this project.

6-053

Category: Drug-Use Evaluation

Title: Implementing practice guidelines of intradialytic hypotension(IDH) prevention and management at a small long-term acute care hospital(LTACH)

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Purpose: IDH is a relatively common complication which occurs in 20 to 30% of conventional dialysis sessions. It is associated with significant morbidity and mortality in patients with renal impairment. Therefore prevention of IDH, especially in hospitalized elderly and vulnerable patients, is critical. The objective of this study is to see the impact of pharmacy intervention on prevention and management of IDH at an 82-bed LTACH.

Methods: A retrospective, cross-sectional chart review for all patients treated with albumin for the period of Feb 1st to Apr 30st, 2015 was conducted to review the appropriate utilization during and after each hemodialysis. IRB exempt approval was requested for this quality improvement project. The study showed that albumin was being used as a first line agent for managing IDH at this facility without any standard guidelines for IDH prevention and treatment. In April 2015, new guidelines on prevention and management of IDH was established at the pharmacy, nutrition and therapeutics committee meeting. Being implemented on May 1, 2015, the guidelines require dialysis nurses to check patient's controlled substance and titrate high blood pressure medications before initiating dialysis.The dialysis team also have to follow new protocols to prevent and treat IDH: 1. Decrease ultrafiltration infusion rate, 2. Restore intravascular volume with 0.9% sodium chloride infusion, 3. Administer 25% albumin(50mL) infusion. 4. Review hemodialysis medication administration record. Number of dialysis sessions, total albumin cost, and patient per day cost were compared before and after implementing IDH management and prevention guidelines. Data will be continuously collected until July 31, 2015 to compare three months before and after new IDH guideline implementation.

Results: During the baseline period of Feb 2015 and Apr 2015 which was before implementation of prevention and management of IDH guidelines, 80% of patients who experienced IDH were treated with albumin. It was also found that IDH prevention was not properly done for most patients. The average patient days(PDs) in hospital during baseline period (from Feb 2015 to Apr 2015) was 1287 with average of 95 patients per month on dialysis. Average doses of 25% albumin(50mL) given to patients for IDH treatment were 89 vials per month during the same period. After implementation of the new guidelines, PDs and number of dialysis cases were similar (1298 and 89 cases in May 2015) while albumin usage has been decreased dramatically.

Only 11 doses of albumin was given during that time. Albumin cost per dialysis went down from $57.11 to $0.08 (88% decrease). Furthermore, albumin cost per patient day decreased from $4.16 to $0.51 (87% decrease from baseline). All IDH episodes during the study period were treated or prevented successfully.

Conclusion: Implementing IDH management and prevention guidelines by the multidisciplinary team showed vast reduction in IDH events and albumin usage as treatment at this facility. It also played a big role in hospital-wide cost savings initiatives. Due to limited sample size, annual follow-up study would be recommended to evaluate the long term effect. This study can be helpful for small size hospitals which provides dialysis.

6-054

Category: Drug-Use Evaluation

Title: Compliance with FDA dose limits in patients receiving simvastatin in a 99-bed community hospital.

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Purpose: In June 2011, the FDA updated simvastatin's package labeling to include new restrictions, dose limits, and contraindications. These changes were implemented to reduce the risk of myopathy and rhabdomyolysis. Currently, 80mg/day of simvastatin is restricted to patients who have been using this dose continuously for 12 months without evidence of myopathy. Additionally, concomitant use of simvastatin with posaconazole, gemfibrozil, cyclosporine, danazol, certain calcium channel blockers, ranolazine, and amiodarone is either now contraindicated or associated with dose limits due to drug-drug interactions. The purpose of this study was to evaluate compliance with FDA labeling changes in adult hospitalized patients receiving simvastatin.

Methods: This retrospective cohort study enrolled inpatients with orders for any strength of simvastatin from September 1st, 2014 through January 31st, 2015. Patients were excluded if they were less than 18 years of age. The primary endpoint was rate of compliance with simvastatin label guidelines regarding dose restrictions, limits, and contraindications. The secondary endpoint was the number of patients who developed myopathy as defined by muscle pain and/or weakness associated with grossly elevated creatine kinase. Data points collected using the CERNER electronic health record included gender, age, simvastatin initiation date, simvastatin dose, concomitant use of interacting medications and their associated dose strength, liver function tests, creatine kinase (CK), serum creatinine, and any symptoms of myopathy.

Results: A total of 175 inpatients had orders for simvastatin during the study period. No patients had orders for simvastatin 80mg/day. No patients had orders for simvastatin to be given concurrently with contraindicated medications. However, 32 patients (18%) received simvastatin with an interacting medication requiring dose limitation and of those, 20 (63%) had simvastatin orders which exceeded the recommended dose limit. Simvastatin doses which should've been limited to 10mg/day, but were instead 20-40mg/day, were ordered in 11/20 patients (55%) and simvastatin doses which should've been limited to 20mg/day, but were instead 40mg/day, were ordered in 9/20 patients (45%). Diltiazem was associated with the highest rate of non-compliant dosing and occurred in 11 patients (55%), amlodipine had the second-highest rate of non-compliant dosing in 8 patients (40%) and amiodarone was associated with non-compliant dosing in 1 patient (5%). In patients receiving both simvastatin and an interacting medication, only 7 out of 32 (22%) had a CK drawn, however none were elevated. One patient with advanced age, renal disease, simvastatin 40mg/day and concomitant diltiazem, all risk factors for statin-induced myopathy, experienced left extremity pain: however, he did not have his CK drawn. No other patients had signs or symptoms of myopathy.

Conclusion: Despite published FDA guidelines, simvastatin is being prescribed inappropriately at our facility when ordered concomitantly with interacting medications. Although there were no reported cases of statin-induced myopathy, simvastatin dose limits were exceeded in 63% of patients with concomitant orders for diltiazem, amlodipine, and amiodarone. This information was shared with providers via the quarterly physicians' newsletter; however, pharmacists can still play a significant role in promoting safe and appropriate use of simvastatin by educating nursing staff and patients regarding signs/symptoms of myopathy and focusing attention on drug-drug interaction alerts during the ordering and verification step of the medication use process.

6-055

Category: Drug-Use Evaluation

Title: Evaluation of dexmedetomidine use at a tertiary medical center

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Purpose: Dexmedetomidine, a centrally-acting alpha-2 adrenergic receptor agonist, is FDA-approved for sedation of critically ill, mechanically ventilated patients and non-intubated patients prior to surgical procedures. The approved dosage for dexmedetomidine continuous infusion is 0.2-1 mcg/kg/hr for a duration not to exceed 24 hours. Doses of up to 1.5 mcg/kg/hr have been studied in clinical trials for periods exceeding 24 hours. Given the high inpatient acquisition cost of dexmedetomidine, the purpose of this study was to evaluate the appropriateness of use at a tertiary medical center.

Methods: This medication use evaluation was an institutional review board-exempt quality initiative study. Data were extracted from the electronic medical records and included all dexmedetomidine doses administered on inpatient floors in 2014. Data collected included number of doses billed, inpatient acquisition cost, frequency, duration, and appropriateness of use. In addition, a cost-savings analysis was conducted based on limiting use to FDA-approved and clinically-studied dosing regimens. Demographic information and in-hospital patient location were also collected. Chart review was performed on randomly-generated patients to obtain information on the rates of dexmedetomidine continuous infusions being routinely used. A survey of critical care pharmacists at the medical center was also performed to gain insight into potential areas for optimization of medication use.

Results: Dexmedetomidine acquisition cost for 2014 was the hospital's sixth highest expenditure totaling $334,966.50 (n equals 3331 total doses billed.) The highest frequency of use was observed in the shock/trauma intensive care unit (ICU), followed by the respiratory, cardiac, and neurology ICUs. The average patient age was 53 (plus or minus 15) years old. Within these ICUs, 10 percent of dexmedetodmine regimens extended beyond 24 hours. Based upon chart review, we found dexmedetomidine continuous infusions were routinely ordered at rates exceeding doses that are FDA-approved or evaluated in clinical trials (e.g., greater than 1.5-2 mcg/kg/hr.) The inpatient acquisition cost of dexmedetomidine for 24 hours based on infusion rates in a 90 kg person was $1404 (2 mcg/kg/hr) vs. $1053 (1.5 mcg/kg/hr) vs. $702 (1 mcg/kg/hr.) Therefore, implementing a soft maximum limit of 1-1.5 mcg/kg/hr for dexmedetomidine infusions has the potential to save $300-700 per patient per day. This cost analysis also suggests that limiting the use of dexmedetomidine infusions to 24 hours has the

potential to save approximately $140-1400 per patient per additional day, depending on the dosing regimen used.

Conclusion: Sedation with dexmedetomidine in the ICU contributes significantly to inpatient medication expenditure. Results of this medication use evaluation suggest strategies may be implemented to optimize the dosing of dexmedetomidine to maintain compliance with FDA-approved and clinically-studied dosing strategies, resulting in potential cost-savings. These would include limiting the duration of dexmedetomidine use to one day and/or applying a soft maximum continuous infusion rate of 1 or 1.5 mcg/kg/hr. Currently, no published literature suggests a positive dose-response curve for dexmedetomidine rates exceeding 1.5 mcg/kg/hr. Future directions for this study include implementing these strategies and measuring their pharmacoeconomic effects and associated patient outcomes.

6-056

Category: Drug-Use Evaluation

Title: Impact of formulary removal of intravenous acetaminophen on overall pharmaceutical costs, opioid costs and length of stay.

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Purpose: Intravenous acetaminophen usage rose steadily from no use in January, 2011 to a high point in April, 2014 of over ten thousand doses. Medication usage evaluations did not show any impact in length of stay, opioid use, or improvement in pain scores, despite anecdotal reports of benefit. After a formal literature review and final MUE, intravenous acetaminophen was removed from the adult formulary in August, 2014. This review was performed to determine the impact of removal from formulary, if any, on opioid costs and length of stay.

Methods: Total cost of medications, total cost of opioid medications and length of stay were assessed in patients receiving intravenous acetaminophen at five facilities between the months of April 2013 and March 2014. The patients were then grouped by diagnosis related group (DRG). The analysis included a review of all patients receiving intravenous acetaminophen as a subset analysis evaluating only gastrointestinal procedures in DRG 329 through DRG 346 and orthopedic procedures including spinal procedures in DRG 454 through DRG 494. The opioid costs and length of stay was then compared to patients with the same diagnosis related group discharge in the time period between October, 2014 and March, 2015 after removal of intravenous acetaminophen from formulary.

Results: A total of sixteen thousand eight hundred eighty-seven patients received intravenous acetaminophen between April 2013 and March 2014. Six thousand five hundred thirty-four patients received intravenous acetaminophen related to a gastrointestinal or orthopedic procedure. Intravenous acetaminophen has not been used in any adult patients since its removal from formulary. Average opioid costs were $26.06 per discharge overall and $32.59 per discharge in the gastrointestinal and orthopedic procedure subgroups. The average length of stay for these groups was 5.37 days and 4.40 days respectively. After formulary removal average opioid costs per discharge were $23.92 overall and $24.86 in the gastrointestinal and orthopedic procedure subgroups. Length of stay was 5.29 days and 4.34 respectively. Length of stay increases of greater than one half day were seen in two diagnosis related groups. DRG 468, revision of hip or knee replacement w/o CC/MCC, had an increased average length of stay of 1.43 days in six patients following removal of intravenous acetaminophen. DRG 493, lower extremity & humerus procedure except hip, foot, femur w CC had an increase of 0.77 days on average in eleven patients in the post acetaminophen group. Overall medication costs were maintained within the expected increase for inflation.

Conclusion: The removal of intravenous acetaminophen did not have a negative impact in either length of stay or consumption rates of opioids as assessed by utilization costs. The formulary removal included recommendations for alternative routes of administration of acetaminophen as well as an emphasis on more cost effective multi-modal pain management therapy.

6-057

Category: Drug-Use Evaluation

Title: Assessing the use of colistin in a tertiary care hospital in Beirut, Lebanon

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Purpose: Colistin belongs to the polymyxin group of antibiotics that was used in the 1960s and was withdrawn because of its nephrotoxicity. More recently, a number of centers around the world have used colistin because of the emergence of multidrug-resistant nosocomial infections, especially those due to Pseudomonas and Acinetobacter spp. The purpose of this study was to assess the appropriate us of colistin in a tertiary referral hospital in Beirut, Lebanon.

Methods: We conducted a retrospective chart review during the months of April and May 2015. Patients hospitalized in the intensive care unit (ICU) or internal medicine service (IM) and received colistin were included in the study. Information gathered included demographic variables, comorbid conditions, physical findings, laboratory and radiographic studies, and patient medical management. Daily follow-up was performed for all patients during their hospital stay. Rating of the appropriateness of colistin use was done through analyzing patients information one by one and referring to the drug monograph and the IDSA guidelines.

Results: During the study period, 50 patients were assessed (47 in ICU and 3 in IM); 18 patients (36%) were started on colistin as targeted therapy while the remaining 32 (64%) received the drug empirically. The use of colistin was rated appropriate in only 17 patients (34%). The dose of the drug was inappropriate in 54% of the patients with the main reason being failure to adjust the dose in patients with renal dysfunction. The appropriateness of the dose could not assess in 2% of the patients due to lack of height and weight documentation. Colistin was used for a mean of 15 15 (mean SD) days (minimum of 1 day and maximum of 38 days) with 20% of the patients receiving the drug longer than deemed necessary. In addition, colistin was continued despite microbiological results showing sensitivity to other antibiotics in 14% of the patients. The most commonly isolated bacteria were Acinetobacter baumani, 23 patients (46%), all of which were sensitive to the drug except for 3, followed by Pseudomonas aeruginosa, 5 patients (10%), all of which were sensitive to the drug. Therapy was successful in 38% of the patients while 50% died.

Conclusion: The use of colistin was inappropriate in the majority of patients. Pharmacists interventions are highly recommended in order to optimize the use of this antibiotic.

6-058

Category: Drug-Use Evaluation

Title: Evaluation of four-factor prothrombin complex concentrate used for reversal of target-specific oral anticoagulants

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Purpose: Target specific oral anticoagulants (TSOACs) have less interactions and stable pharmacokinetics that do not require patient monitoring compared to warfarin. The lack of an antidote for the TSOACs, however, makes it difficult for clinicians to reverse it during a severe bleeding event. Kcentra is a non-activated four-factor prothrombin complex concentrate that is approved urgent reversal of warfarin. There is limited data on patients receiving KcentraTM for the reversal of TSOACs, though studies show that it may be effective. The purpose of this study is to evaluate the outcomes of patients who received Kcentra for the reversal of either apixaban, dabigatran,

Methods: Retrospective data was collected from admitted patients who received Kcentra between October 2013 until April 2015. Patients were included in the study if they received KcentraTM for reversal of a TSOAC and had a one month follow-up of labs or imaging studies. Data collection included baseline hemoglobin/hematocrit, international normalized ratio (INR), age, type of severe bleeding (if applicable), most recent imaging studies, and outcomes after KcentraTM infusion. Severe bleeding was defined as: fatal bleeding, symptomatic bleeding in a critical area or organ including intracranial, intraspinal, intraocular, retroperitoneal, intra-articular, pericardial, or intramuscular with compartment syndrome, > 5g/dL decrease in Hgb concentration or >15% decrease in the hematocrit resulting in substantial hemodynamic compromise or compression of a vital structure. Patients lost to a one month follow-up mark were excluded from data analysis.

Results: There were 19 patients that met the inclusion criteria and were included in the study. Our data demonstrates that over half of patients who received KcentraTM for severe bleeding caused by a TSOAC had resolution of bleeding or medical stabilization that allowed them to be discharged from the hospital. There were no patients that had development of a new thrombosis or stroke within one month of follow-up. There was one patient who had severe ventricular fibrillation shortly after the infusion of KcentraTM. There were three patient deaths and three patients who were taken off of anticoagulation indefinitely.

Conclusion: Patients who received prothrombin complex concentrate (KcentraTM) for bleeding associated with the newer oral anticoagulants did not experience significant negative outcomes and had variable resolution of their bleeds. Time to administration of up to 45 minutes after the finding of a severe bleed did not seem to be associated with lack of efficacy. Further study is needed to find an optimal administration time.

6-059

Category: Drug-Use Evaluation

Title: Efficacy, Safety, and Tolerability of Human Immune Globulin Subcutaneous, 20%: Interim Analysis of a Phase 2/3 Study in Patients with Primary Immunodeficiencies in North America

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Purpose: Immunoglobulin G (IgG) replacement therapy in patients with primary immunodeficiencies (PID) typically requires a dose of 300-600 mg/kg body weight of an IgG 10% solution, easily achieved intravenously (IGIV). Subcutaneously administered IgG (IGSC) can be as effective as IGIV but has decreased bioavailability and infusion volume limitations at a single site. A higher IgG protein concentration may help address volume limitations by enabling smaller infusion volumes compared with less concentrated IgG products. We report results from a study of human immune globulin subcutaneous, 20% (IGSC 20%) in patients aged at least 2 years with PID in North America.

Methods: Epoch 1 (13 weeks): immunoglobulin G 10% was administered intravenously at prestudy doses every 3-4 weeks. Epochs 2-4: IGSC 20% was administered weekly (Epoch 2 [for approximately 12-16 weeks], 145% of the weekly equivalent Epoch 1 dose; Epoch 3 [12 weeks], dose adjusted per AUC assessments in Epochs 1-2; Epoch 4 [40 weeks], dose adapted individually per Epoch 3 serum IgG trough levels). The primary endpoint is the rate of validated acute serious bacterial infections (VASBIs).

Results: Patient study participation finished; 67/77 completed the study. Of the 75 patients who received at least 1 IGSC 20% treatment, 50.7% are male, median age is 37 (range 3-83) years, and median BMI is 25.2 (11.7-42.9). As of the 3rd interim analysis in November 2014, during IGSC 20% treatment in 74 patients, no VASBIs were reported. The all infection rate per patient-year was 2.30 (IGSC 20%) and 3.62 (IGIV 10%). There were no serious adverse events (AEs) or severe AEs related to treatment with IGSC 20%. Rates per patient-year of local AEs considered related to treatment was 0.84 (IGSC 20%) and 0.10 (IGIV). Rates per patient-year of systemic AEs considered related to treatment was 1.33 (IGSC 20%) and 3.36 (IGIV); only 1 severe (non-serious) related systemic AE was reported with IGIV. A total of 2897 IGSC 20% and 322 IGIV infusions were administered. Of 2805 IGSC 20% infusions (with complete infusion histories), 99.7% were completed without slowing the rate, or interrupting or stopping administration. Mean serum IgG trough level attained for patients treated with IGSC 20% (16.1 g/L [1-week

interval; n=70]) was higher than the mean with IGIV 10% (11.5 g/L [3-week interval, n=18]; 10.7 g/L [4-week interval, n=46]).

Conclusion: IGSC 20% provided an effective, well-tolerated therapy in patients with PID. This study aims to confirm the efficacy, safety, tolerability, and pharmacokinetics of IGSC 20% over a 12-16-month treatment period.

6-060

Category: Drug-Use Evaluation

Title: Usage of bevacizumab in ovarian cancer patients, a single institute experience

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Purpose: Bevacizumab is an anti-angiogenic agent that was approved by the National Comprehensive Cancer Network (NCCN) guidelines for the management of advanced ovarian cancer. It was approved in the upfront setting with two dosing regimens; 7.5mg/kg and 15mg/kg every three weeks. The efficacy of the two doses is comparable, suggesting that the higher dose is unnecessary and there is no observable dose response above 7.5 mg/kg q3w. The NCCN also recommends its use in combination with chemotherapy for both platinum sensitive/resistant recurrent ovarian cancers. The aim of this study is to evaluate the use of bevacizumab against the NCCN guidelines.

Methods: A retrospective observational chart review for all ovarian cancer patients receiving bevacizumab was performed in the study period from Feb 2013 to May 2014. This study was approved by the institutional review board. Patient demographics, indications, chemotherapy protocols, and presence of adverse events were documented. A literature review was done on the use of bevacizumab in ovarian cancer with a focus on its potential benefits and adverse events that were associated with its use in this population.

Results: The medical charts of 31 patients were reviewed. As per the inclusion criteria, all patients were females with advanced stages of ovarian cancer. Seven patients received bevacizumab in the upfront setting and the rest 24 patients received it for subsequent lines of therapy. Only one patient received bevacizumab dose of 15mg/kg, and the rest 6 received it as 7.5mg/kg. Ten patients received bevacizumab in recurrent disease after prior use of bevacizumab in previous lines of therapy which is considered against the NCCN recommendations. The current available data provide robust evidence for the role of bevacizumab in ovarian cancer treatment. However, its activity in patients whose disease relapses after first-line bevacizumab-containing therapy is still unknown. With regards to toxicity, five patients experienced elevated blood pressure readings and one out of them required hospital admission to control it. Unfortunately, the use of bevacizumab was associated with grade-4 rectal bleeding which required hospital admission and surgical intervention. Different risk factors were present beside the use of bevacizumab in these patients. However, bevacizumab is well known for those side effects and close follow up plus proper patient/family education should be carried out to help detect early signs of toxicity with immediate intervention if needed

Conclusion: One third of the studied population received bevacizumab beyond progression, which was against the recommendation of the NCCN. In colorectal cancer, continuing

bevacizumab with second-line chemotherapy significantly improved overall survival in patients who had received first-line bevacizumab-containing regimens. However, prospective randomized trials in ovarian cancer are eagerly awaited although if they suggest that bevacizumab should be continued, are likely to generate further questions about dose, duration and perhaps most importantly the economic viability of such a strategy. Given the substantial cost of bevacizumab and till further evidence, it is important to reinforce its appropriate use as per the guidelines

6-061

Category: Drug-Use Evaluation

Title: Long-Term Safety, Efficacy, and Tolerability of Recombinant Human Hyaluronidase-Facilitated Subcutaneous Infusion of Immunoglobulin G in Pediatric and Adult Patients With Primary Immunodeficiencies

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Purpose: Recombinant human hyaluronidase (rHuPH20)-facilitated subcutaneous infusion of immunoglobulin G (IgG) (IGHy; HYQVIA) is approved for the treatment of primary immunodeficiencies (PIDs) in adults. IGHy overcomes some of the limitations associated with intravenously- and conventional subcutaneously-administered IgG. We report the efficacy, safety, and tolerability of IGHy in pediatric and adult patients who were treated for up to approximately 3.5 years in the IGHy pivotal phase 3 study and its extension.

Methods: Eight-three patients (aged 4-78 years) with PID received IGIV for 3 months, then IGHy (75 U rHuPH20/g IgG administered SC followed by IgG 10% administered through the same needle) every 3 or 4 weeks for approximately 18 months. Sixty-three patients continued to receive IGHy for up to an additional 21 months in the extension study. rHuPH20 was discontinued after up to approximately 3.5 years of exposure.

Results: Maximum IGHy exposure was approximately 3.5 years (188 patient-years); 57.8% (n/N=48/83) of patients were exposed to IGHy for >1000 days. Adverse reactions (ARs; defined as causally and/or temporally associated adverse events [AEs] occurring within 72 hours) per infusion were 0.168 (local) and 0.178 (systemic) with IGHy, and 0.011 (local) and 0.422 (systemic) with IGIV. No serious AEs related to IGHy were reported. The rate of all infections per patient-year with IGHy was 2.99 (95% confidence interval, 2.6-3.42). Out of 2959 IGHy infusions 68.1% (n=2016) were completed using only one infusion site. Overall, 85.5% of patients were infused with IgG 10% volumes of at least 200 mL into a single site (67.9% of infusions; 2008/2959). Fifteen patients developed binding anti-rHuPH20 antibody titers of at least 1:160 on 1 or more occasions with no associated ARs; titers declined to levels observed in the normal population in all patients who continued on treatment with IGHy. No patient developed neutralizing anti-rHuPH20 antibodies.

Conclusion: In pediatric and adult patients who were treated with IGHy for up to approximately 3.5 years, infection rates were low, infusions were well-tolerated and, despite infusion volumes and rates similar to IGIV, systemic AE rates were lower with IGHy than with IGIV.

6-062

Category: Emergency Medicine / Emergency Room

Title: Evaluation of pharmacist-driven emergency department culture review on readmission rate

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Purpose: Serving as an antimicrobial steward is an additional role for clinical pharmacists in the emergency department (ED). At our institution, culture review was changed from nursing to clinical pharmacist management in October 2013 and occurs seven days a week. The purpose of this study was to determine whether clinical pharmacist-driven ED culture review decreases the five-day rate of readmission due to infection when compared to nursing-driven review.

Methods: This institutional review board exempt study was a retrospective review of positive culture results from patients treated and discharged from the ED. All patient charts were reviewed for readmission due to documented infection up to five-days after the initial date of positive culture. Readmission was defined as patient re-presentation to the ED with or without hospital admission. Infection was defined as urinary tract infection, cellulitis or wound infection, bacteremia, sepsis, fever, upper or lower respiratory tract infection, or miscellaneous infection. 681 patients were evaluated for readmission from nursing-driven culture review documentation during a six-month period from October 2012 to April 2013. Of the 681 patients, 464 were not originally included in nursing documentation of culture review and were therefore added during execution of this study based on archived culture data. 751 patients were evaluated for readmission from clinical pharmacist-driven culture review documentation during a six-month period from October 2014 to April 2015. ED providers (physicians, nurse practitioners, and physician assistants) were provided with antibiotic selection education prior to the six month period of pharmacist culture review. Providers were given our ED-specific antibiogram to help guide antimicrobial selection. Evaluation of data was performed using Chi-square analysis.

Results: Fifty-four patients were readmitted during nursing-driven culture review, 26 of those readmitted due to infection, with a five-day readmission rate due to infection of 48.1 percent. Sixty-six patients were readmitted during clinical pharmacist-driven review, 19 of those readmitted due to infection, with a five-day readmission rate due to infection of 28.9 percent. The transition from nursing to clinical pharmacist-driven review of positive cultures from the emergency department resulted in 19.2 percent lower five-day rate of readmission due to infection (p-value equals 0.029). During the period of nursing review, one patient was readmitted due to bacteremia, without a prior call-back to the patient by a nurse. Twelve patients with bacteremia were readmitted during the period of clinical pharmacist review due to pharmacist intervention and were excluded from readmission rate calculations.

Conclusion: When compared to nursing-driven review, clinical pharmacist-driven ED culture review at our institution decreased five-day rates of readmission due to infection. Capture and documentation of positive culture data was more complete when managed by clinical pharmacists, allowing more opportunity for initiation of appropriate therapy.

6-063

Category: Emergency Medicine / Emergency Room

Title: Impact of a clinical pharmacist on medication reconciliation accuracy in the emergency department (ED)

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Purpose: Accurate patient medication histories are often difficult to obtain, particularly in the high-risk, fast-paced setting of the Emergency Department (ED). The addition of a clinical pharmacist to the interdisciplinary team in the ED can result in improved accuracy of medication histories upon admission, allowing for a more thorough and complete patient admission. A 4-week demonstration pilot was implemented to justify the value of an ED clinical pharmacist in enhancing overall ED workflow, reduction in potential medication errors, and most importantly, improving patient safety.

Methods: A clinical pharmacist was added to the ED team to improve the accuracy of the medication reconciliation process that was being performed and managed by the triage nurses. Pharmacists were incorporated into the ED team during a 4-week pilot period to provide 12 hours of coverage Monday through Friday. The pharmacist was consulted by nurses and ED physicians to perform medication reconciliation for high-acuity patients likely to be admitted to the hospital. After initial medication reconciliation was completed by the triage nurse, the pharmacist performed a second, more thorough medication reconciliation using information obtained from the patient, patients family member(s), local pharmacies and physician offices. The pharmacist-obtained medication reconciliation was utilized to correct any errors/discrepancies that occurred during the nurse-obtained medication reconciliation in the patients EMR. The number of discrepancies between the pharmacist and nurse performed medication reconciliation were tabulated, along with the pharmacist time spent collecting the accurate medication reconciliation, and time saved for the ED admitting nurse.

Results: A total of 327 patients had medication reconciliations performed by a clinical pharmacist in the 4-week timeframe. During this pilot program, 2,959 pharmacist interventions (average 9 interventions/patient) were performed to identify missing data (missing drug, dose, frequency, route, dosage form or duration) omitted from the nurse-obtained medication reconciliation. In addition, 222 interventions (average 1.5 interventions/patient) were performed to identify incorrect data (incorrect drug, dose, frequency, route, dosage form or duration) entered in the nurse-obtained medication reconciliation. Pharmacist time spent per patient medication reconciliation decreased over the course of the pilot from 71 percent of medication

reconciliations taking 30 minutes or less in week one, to 92 percent taking 30 minutes or less in week 4. A small subset of patients had time studies performed by the ED admitting nurse to determine the amount of time saved during the admission process when pharmacist-obtained medication reconciliation was completed. Overall, 11 patients with 76 total medications had a pharmacist-obtained medication reconciliation, as compared with 30 patients with 348 medications who had a nurse-obtained medication reconciliation. Patients with pharmacist-obtained medication reconciliation had an average time spent that was one minute less per medication (1.3 minutes/medication) versus the nurse-obtained medication reconciliation (2.3 minutes/medication).

Conclusion: The addition of a pharmacist in the ED during this 4-week pilot program demonstrated the benefit of clinical pharmacists and their role in collecting an accurate medication reconciliation. The number of interventions for missing/incorrect data on the medication reconciliation suggests that the involvement of pharmacists in the medication reconciliation process may reduce errors and improve patient safety. The pharmacist-obtained medication reconciliation also demonstrated a decrease in the amount of time spent by the ED admitting nurse collecting the same information. In conclusion, the addition of a clinical pharmacist to the ED interdisciplinary team enhanced patient care and overall workflow.

6-064

Category: Emergency Medicine / Emergency Room

Title: Impact of prospective pharmacist processing of emergency department (ED) medication orders in a small community hospital

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Purpose: A high amount of medication errors were being reported from the emergency department (ED). These errors were discovered from the pharmacists daily retrospective review of all ED orders, a process that was implemented to identify trends in errors and improve medication safety. This was the only oversight from pharmacists at that time in the ED. It was decided in April 2014 to have pharmacists prospectively review all physician medication orders prior to nurse administration in an effort to decrease errors. The purpose of this study was to determine the effectiveness of this intervention on medication error rate in the ED.

Methods: A retrospective review was done to compare the difference in medication error rate before and after implementation of pharmacists processing all ED physician medication orders. Data was collected for a year prior to (April 1, 2013 March 31, 2014) and a year after (April 1, 2014 March 31, 2015) the new intervention. All patients that presented to the ED and received medications within that time frame were included. Data collected included number of medications administered, number of errors reported (both total and number that reached the patient), the percent of errors per medications administered, and the percent change in errors overall. All data was abstracted from the electronic medical record and pharmacy quality assurance data. This review was approved by the hospitals ethics committee.

Results: The total number of physician orders the year prior to a pharmacist processing ED physician orders was 38,528. During that time there were a total of 718 reported errors of which 604 reached the patient. The overall error rate prior to pharmacists processing ED physician orders was 1.9 percent. The total number of physician orders the year after a pharmacist processing ED physician orders was 41,758. During that time there were a total of 97 reported errors of which 74 reached the patient. The overall error rate after pharmacists processing ED physician orders was 0.2 percent. Overall, there was an 89 percent decrease in reported errors when pharmacists processed the physician medication orders.

Conclusion: Patient safety was positively impacted when pharmacists prospectively processed all physician medication orders prior to nurse administration. With this new process the pharmacists were able to prevent medication errors before they occurred. Preventable errors included identifying and intervening on allergies, duplicates, contraindications, and incorrect doses. As a result of utilizing pharmacists expertise in medication management and its overall

success in decreasing medication errors, it was determined that all orders will continue to be processed by pharmacists prior to administration.

6-065

Category: Emergency Medicine / Emergency Room

Title: Potential role for pharmacy students in the emergency department during a six-week advanced pharmacy practice experience

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Purpose: The role of pharmacy services in the emergency department is ever expanding. Pharmacy students can learn and have a positive impact on patient care while in the emergency department. This report describes pharmacy students roles and interventions in the emergency department.

Methods: During the span of three consecutive six-week advanced pharmacy practice experiences, six students were integrated into the emergency department. Prior to the students integration into the emergency department, the University of Louisiana at Monroes School of Pharmacy and Iasis healthcare entered into contract to secure a pharmacist in the emergency department at Glenwood Regional Medical Center for a dedicated 20 hours a week. Pharmaceutical services that were provided by the students included medication discharge education, admission medication reconciliation, and providing drug information to the emergency department team. Methods used to evaluate the effectiveness of the advanced pharmacy practice experience included: student evaluation of the experience, number of student made interventions, and emergency department staff surveys.

Results: Students completed 361 medication reconciliations and 98 medication discharge counselings during their time in the emergency department. According to the post survey completed by the emergency department staff, pharmacy students are excellent in their ability to provide medication and therapy related education to patients, and the emergency department staff. Pharmacy students rated their overall experience in the emergency department a 4 for superior, and comments were very positive.

Conclusion: The emergency department provides a unique and valuable advanced pharmacy practice experience for students. Students are able to solidify patient interaction skills as well as cover multiple common disease related topics during there tenure in the emergency department. Students also make an appreciated contribution to the emergency department, by completing medication reconciliations and providing patient discharge counseling/education.

6-066

Category: Emergency Medicine / Emergency Room

Title: Future extended role of pharmacists in hospital emergency departments

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Purpose: At present there are concerns about maintaining appropriate clinical staff levels in Emergency Departments in England, UK. Pharmacists are experts in pharmaceutical care, medication reconciliation, medicines optimisation. In the UK, with further training, pharmacists may also become fully independent prescribers. However, they may have further untapped potential and may be able to extend their clinical role beyond that of current clinical pharmacist roles. The purpose of this study was to explore the potential clinical management roles that hospital pharmacists could undertake within Emergency Departments.

Methods: A prospective dual-site cross sectional observational study of patients attending Emergency Departments (ED) in England was conducted over a five week period in 2014. The pharmacist independent prescribers (one for each site) were asked to identify patient attendance at their ED, record anonymised details of cases and categorise each into one of four possible categories: CP, Community Pharmacist, cases which could be managed by a community pharmacist in a community pharmacy; IP cases that could be managed in ED by a hospital pharmacist with independent prescriber status; IPT, Independent Prescriber Pharmacist with additional training cases which could be managed in ED by a hospital pharmacist independent prescriber with additional clinical training; MT, Medical Team only cases that were unsuitable for the pharmacist to manage. Blinded secondary categorisations of the cases were conducted by two community pharmacists and two ED medical consultants. Ordinal scaling was used to determine the level of agreements between the categorising groups. Cases were classified into eighteen clinical groupings, and an Impact Index, was calculated for each using the formula: Impact equals percentage workload of the clinical group multiplied by percentage classed as suitable for a pharmacist to manage within that clinical group.

Results: 782 patient admissions were recorded. Blinded categorisation of the cases found that 3.21% of the cases were considered suitable for pharmacist management outside the hospital in community pharmacy and 5.12% were considered suitable for a hospital pharmacist independent prescriber. An additional 39.9% were considered suitable for a hospital based independent prescribing pharmacist management after further advanced clinical practice training (proposed length of training was 1 year). There was a high degree of general agreement between the 3 categorizing groups (hospital and community pharmacists and ED medical consultants, with overall categorisation scores of 3.45, 3.34 and 3.37 respectively). ANOVA analysis confirmed

that agreement was found between hospital pharmacists and medical consultants, and between community pharmacists and ED medical consultants. The clinical groupings with the most frequent patient admissions came from orthopaedics (25%), general medicine (23%), neurology (11.5%), gastroenterology (7.3%), and cardiology (5.8%). The impact index was highest for ED admissions classed as orthopaedic (19.8) and general medicine (12.8). The Impact Index is a measure of the potential for pharmacists to impact positively on the workload of EDs (the higher the greater the impact).

Conclusion: This study confirms that there is moderate scope for pharmacists to manage patients attending ED, approximating to 1 in 12 patients. A review of cases attending ED undertaken by a multi-professional group consisting of pharmacists and medical staff, suggests that there is potential for pharmacists to manage up to 48.2% of ED attendees, provided they received further structured training of no more than 12 months duration. Training in clinical specialities with a high impact index may be most suitable for pharmacist with clinical roles within emergency medicine.

6-067

Category: Emergency Medicine / Emergency Room

Title: Current Practice of Hypoglycemia Management in the Emergency Department

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Purpose: Hypoglycemia affects emergency department (ED) practitioners consistently as annual ED visits remain unchanged between 2006 and 2009. In severe cases of hypoglycemia, glucagon and dextrose play a role in the management of patients; however, these medications have short durations of action leaving patients susceptible to further hypoglycemic events. The purpose of this study is to characterize the management of hypoglycemia in a busy, adult ED. We also describe patient characteristics associated with refractory (need for additional treatment following initial management) and recurrent [resolution of hypoglycemia with treatment (blood glucose [BG] ≥80 mg/dL) followed by a subsequent BG ≤50 mg/dL) hypoglycemia.

Methods: This is a retrospective review of patients who presented to an academic ED for hypoglycemia between January through December 2014. Adult patients were identified using ICD9 codes for hypoglycemia or a documented BG ≤50 mg/dL at initial ED presentation. Patients whose hypoglycemia developed after ED presentation were excluded. Demographic information including age, weight, gender, comorbidities (diabetes mellitus, coronary artery disease, current/recent infection, chronic/acute renal disease, and alcohol use disorder), and outpatient medications (specifically those associated with hypoglycemia) were collected. We captured both prehospital and ED glucose values and collection times, and treatment including the medication, dose, route, and time of administration. The primary outcome was to characterize the time to recognition and treatment, and to describe usual treatment practices. The secondary outcome was to identify patient characteristics associated with refractory and recurrent hypoglycemia. Descriptive statistics were used to report the primary outcomes and Chi-Square or Fishers Exact as appropriate to analyze the secondary outcomes.

Results: Eighty-two patients were included (average age 73.3 +/-16.2 years, weight 83.7 +/-23.0 kg, 45.1% male). Fifty-eight patients had at least one prehospital BG (mean 40.3 +/-17.6 mg/dL) and 51 patients received treatment 8.5 +/-11.1 minutes after BG (dextrose or glucagon). At ED presentation, 81 patients (98.8%) had at least one BG recorded and 75.6% had a BG drawn within 60 minutes. The mean initial BG was 63.6 +/-39 mg/dL. There were 47 patients who had a BG ≤50 mg/dL, however, only 35 (74.5%) received subsequent IV dextrose (no patients received glucagon), administered 32.6 +/-44 minutes following the BG. A total of 60 dextrose IV boluses were administered in the ED [mean dose 27.5 +/-9.79 g (0.33 mg/kg)]. The average time between all BGs and treatment was 25.5 +/-37.3 minutes. There were 39 patients (54.2%) that experienced refractory/recurrent hypoglycemia. Infection was the only patient characteristic (demographic, comorbidity, or outpatient medication) that was associated with this occurrence (p

= 0.009). Of concern, 26% of patients did not have resolution of hypoglycemia within four ED BGs and of 66 patients that received at least one treatment dose (dextrose or glucagon), only 68.2% received subsequent dextrose containing IV fluids or had food intake documented.

Conclusion: We found that only 75.6% of patients had a BG documented within an hour of ED arrival and the time to treatment was almost 30 minutes following BG. Additionally, there was a high incidence of refractory and recurrent hypoglycemia which could be contributed to inadequate dextrose bolus doses as most adult patients received 25 g of dextrose regardless of weight or lack of continuation of maintenance therapy (dextrose containing fluids or food). We did find an association with current/recent infection and incidence of refractory/recurrent hypoglycemia.

6-068

Category: General Clinical Practice

Title: Severe hyponatremia associated with trimethoprim sulfamethoxazole: a case report

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Case Report: This case describes severe hyponatremia associated with trimethoprim sulfamethoxazole. Institutional review board determined that this case does not constitute clinical research. Therefore, institutional review board review and approval of this case report is not required. A seventy year old female presented to the hospital with a dry cough and dyspnea. She had a recent admission to an outside hospital, where she was treated for community acquired pneumonia and discharged on levofloxacin and a prednisone taper. She had a past medical history of chronic obstructive pulmonary disease, hypertension and hyperlipidemia. Medications at home were prednisone, hydralazine, valsartan, fluticasone salmeterol inhaler, diazepam, aspirin, and multivitamin. She was found to have a new diagnosis of human immunodeficiency virus infection, acquired immunodeficiency syndrome and severe Pneumocystitis jirovecii pneumonia. Patient was intubated and received care in the intensive care unit. Patient was initiated on trimethoprim sulfamethoxazole 560 mg intravenously every eight hours for seventy two hours, after which the dose was decreased to 250 mg intravenously every six hours. On admission, the patients sodium was 137 mmol/L and potassium was 4.8 mmol/L. After three days of treatment, sodium was 135 mmol/L and potassium was 5.2 mmol/L. Despite efforts to limit intravenous fluids containing dextrose and resuscitation with saline fluids, sodium level continued to decrease further to a nadir of 116 mmol/L and potassium level increased to 7.3 mmol/L on day twelve of therapy. Patient also developed acute renal failure. Patient was not clinically improving at that time, thus it was decided to discontinue trimethoprim sulfamethoxazole and start intravenous pentamidine daily. Subsequently, sodium level improved to 128 mmol/L and potassium level to 5.5 mmol/L within forty eight hours of discontinuing trimethoprim sulfamethoxazole. Sodium level improved further to 138 mmol/L seven days after discontinuation of trimethoprim sulfamethoxazole. This case illustrates the importance of recognizing trimethoprim sulfamthoxazole associated hyponatremia in order to initiate steps for its management.

6-069

Category: General Clinical Practice

Title: Improving Dashboard Metrics Through A Collaborative Care Pharmacy Service On A Neuroscience Unit

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Purpose: Studies have demonstrated that medication misadventures are a reason for hospital readmission. Readmissions can be decreased by medication reconciliation on admission and before discharge. In 2012, the Centers for Medicare and Medicaid Services implemented their plan to decrease reimbursement for hospitals for excessive readmissions as well as not meeting certain patient satisfaction metrics which included medication communication. The implementation of our collaborative pharmacy services project was designed to improve medication communication, shorten length of stay (LOS), decrease readmission rates, and improve the global rating for patients admitted to the neuroscience unit at St Ritas Medical Center.

Methods: In July 2014, a full-time dedicated residency-trained pharmacist began providing collaborative care services on the unit. Data was collected from July 2014 to April 2015 and compared to the previous ten months. Collaborative care was designed to increase communication between pharmacists, physicians, nurses and patients with an overall increase in coordination of care. Due to the incidence of cognitive dysfunction associated with many patients admitted to the neuroscience unit, initial pharmacist responsibilities included completing medication histories and discharge patient counseling. Other services provided included rounding with physicians, making drug therapy interventions, and providing medication dosing services. Data for all HCAHP (Hospital Consumer Assessment of Healthcare Providers and Systems) metrics (medication communication, length of stay, readmission rates and overall global rating) were collected through review of HCAHPS scores at the beginning of the study and at the completion of the study.

Results: In the nine months prior to starting collaborative care, the average score for communication with medications was 49%, compared with 68.3% after implementation. In addition, the global rating for the unit increased by 21.4% (58.4 % pre vs 79.8% post). Average length of stay decreased by 0.08 days with the implementation of collaborative care (average LOS 3.75 days vs 3.66 days). The overall readmission rate for the unit was 10.7% prior to implementation vs 12.7% post.

Conclusion: Collaborative pharmacist services improved medication communication, overall global unit rating and length of stay. With continued services, pharmacy hopes to make further gains in decreasing LOS and making improvements in medication communication and readmission rates for the unit.

6-070

Category: General Clinical Practice

Title: Piperacillin tazobactam induced hemolytic anemia: a case report

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Case Report: This case describes hemolytic anemia induced by piperacillin tazobactam. Institutional review board determined that this case does not constitute clinical research. Therefore, institutional review board review and approval of this case report is not required. A fifty six year old female presented to the hospital with altered mental status and hypotension. She has a past medical history of end stage renal disease on hemodialysis with failed kidney and pancreas transplant, coronary artery bypass graft, bioprosthetic mitral valve replacement four months prior to admission for severe mitral regurgitation, recurrent mitral valve endocarditis, diabetes mellitus type II, hypertension and history of stroke. Home medications included sertraline, rosuvastatin, warfarin, pantoprazole, sevelamer, darbepoetin, insulin lispro and insulin glargine. Patient had multiple allergies including vancomycin (hearing loss and Stevens Johnson syndrome), mycophenolate mofetil (pneumonia), tetracycline (hypoglycemia), fish (vomiting), egg (rash), bee stings (swelling), citrus (rash) and clotrimazole. Patient was diagnosed with bacteremia secondary to hemodialysis line infection and endocarditis. The patient received one dose of linezolid and one dose of daptomycin within 24 hours of admission. Enterobacter grew in two out of two blood cultures. The patient was started on piperacillin tazobactam for treatment and the hemodialysis line was removed. At admission, the patient had a baseline hemoglobin of 9.9 g/dL. Eight days later, the hemoglobin level dropped to 6 g/dL. Patient received a transfusion of red blood cells and responded initially. Subsequently, hemoglobin continued to drop. The lowest hemoglobin was 4.4 g/dL on day 10 of therapy. There were no signs of active bleeding. Anemia work up revealed a positive DAT COOMBS test indicating hemolytic anemia. Piperacillin tazobactam was discontinued and the patient was switched to ceftriaxone for treatment of the endocarditis. For the management of hemolytic anemia, patient received prednisone 1 milligram per kilogram (total 60 milligrams) orally daily, darbepoetin 200 micrograms subcutaneous additional dose, and a repeat blood transfusion. Hemoglobin level improved gradually to 9.7 g/dl at the time of hospital discharge. The time response of this reaction, the laboratory tests, the withdrawal of piperacillin tazobactam and subsequent improvement of hemoglobin support that this is a case of piperacillin tazobactam induced hemolytic anemia. This case illustrates the importance of recognizing drug induced hemolytic anemia.

6-071

Category: General Clinical Practice

Title: Improved patient satisfaction associated with discharge medication counseling via multimedia teleconferencing

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Purpose: Hospital patients discharged home are requested to rate their perceived quality of care by participating in a standardized survey that includes questions pertaining to patients understanding of their medications. Moreover, discharge medication counseling has been associated with reduced readmission rates in published literatures. Nurses may not be able to provide effective discharge medication teaching due to time constraints and unfamiliarity with some medications. The objective of this study was to assess the improvement of patient satisfaction associated with discharge medication counseling by pharmacists via multimedia teleconferencing at a 212-bed acute care hospital.

Methods: A pharmacy-led interdisciplinary team of pharmacists, nurses, and unit secretaries developed a discharge medication education process to improve patient care by utilizing multimedia communication technology at CHI St. Lukes Health The Woodlands Hospital, in the Woodlands. Texas. The pilot study was conducted on a 28-bed medical-surgical floor from May to June 2014. Inclusion criteria were patients greater than 18 years old, who were discharged home, and whose discharge medications included new prescriptions. Exclusion criteria were patients discharged to long term acute care facilities or nursing homes. In this study, after a physician completed discharge orders, the unit secretary connected a clinical pharmacist with the patient to be discharged via multimedia technology. After reviewing the patients electronic medical record, the clinical pharmacist subsequently conducted discharge medication counseling and answered medication-related questions efficiently on the teleconferencing screen without leaving the workstation. The focus of medication counseling was to ensure the patient understands the purposes and possible side effects of the new medications before leaving the hospital. After the remote counseling session, patients bedside nurse was notified. The nurse then completed the remaining discharge process, as well as prompted the patient to complete a short internal satisfaction survey on the teleconferencing counseling session.

Results: This novel and efficient medication education process was well received by patients, nurses, pharmacists, and unit secretaries. Among the 46 internal patient surveys administered before the participants left the hospital, 100% patients reported that the technology was easy to

use, 100% understood the purposes of their new medications, and 97% understood the possible side effects. In addition, the patient satisfaction scores on standardized surveys were compared between the first and second quarters of 2014. During the second quarter, 75.9 % of patients reported that hospital staff had told them what the medicine was for, compared with 71.7% in the first quarter; 53.5% of patients reported that hospital staff described possible side effects in a way they could understand, compared with 37.0% in the first quarter; 71.1% patients clearly understood the purpose for taking their medications, compared with 64.5% in the first quarter.

Conclusion: We demonstrated valuable quality improvement for patient care when a pharmacy-led interdisciplinary collaboration implemented a novel discharge medication counseling process. The multimedia teleconferencing technology was easy to use and well received. Internal patient surveys provided excellent satisfaction ratings on the multimedia education process for discharge medication counseling. Quarterly patient satisfaction scores on standardized surveys also showed improvement on all three medication-related questions. However, HIPAA and information technology issues may present barriers to the full implementation of this multimedia communication technology.

6-072

Category: General Clinical Practice

Title: Categorization of reasons why patients declined to participate in a randomized controlled study on transition from hospital to primary care

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Purpose: The coordination between primary and secondary health care is in the literature described as a sensitive issue with respect to the patients medical treatment. Especially the transition from hospital to primary care can be subject to errors. Elimination of errors related to the medical treatment during admission and after discharge from the hospital to the primary health care is of a great priority. Hence, the purpose of the study was to determine the demography and explore the reasons why patients decline to take part in a multifaceted pharmacist intervention based on medication review, medication interview and follow up.

Methods: The patients who declined to participate were asked by the pharmacist why they declined. The self-reported reasons were listed and reviewed. In order to create an overview the patients different reasons had to be arranged into overall categories. These categories were chosen to reflect the patients answers in the best possible way. The result of this process yielded seven different categories. This categorization was a sub analysis from a prospective, blinded, randomized controlled study which was conducted with patients at an Acute Medicine Admission ward at Odense University Hospital, Denmark. The study was approved by The Regional Scientific Ethical Committees for Southern Denmark. The criteria for inclusion were: 18 years or above, usual medicine of five drugs or above, speak and understand Danish, admitted via the Acute Medicine Admission ward. Exclusion criteria were: Terminal illness, suicidal toxic reaction, restraint patients, severe dementia and im- or expressively aphasic patients. The patients were identified eligible by reviewing the electronic patient chart and were given oral and written information about the study and where included after possibility for asking questions. The patients had to give written consent.

Results: 212 (19 percent) out of 1096 patients declined to participate. 85 (40 percent) were males and 127 (60 percent) were females. There were no statistically significant difference in average age between male (73 years) and female participants (76 years). The reasons to decline were categorized as following: 16 patients (eight percent); six women (age 36 to 94) and ten men (age 57 to 89) expressed themselves unable to follow study protocol agreements, 94 patients (44 percent); 67 women (age 50 to 100) and 27 men (age 45 to 91) had no surplus of mental resources, three patients (one percent); two women (age 86 to 93) and one man (age 60) had physical limitations, 22 patients (ten percent); 14 women (age 81 to 99) and eight men (70 to 92) stated age as their reason, 43 patients (20 percent); 27 women (age 45 to 87) and 16 men (age 64 to 79) felt lack of study benefits, 21 patients (ten percent); seven women (age 57 to 84) and 14

men (age 52 to 96) stated no reason for declining and 13 patients (six percent); five women (age 67 to 82) and eight men (age 53-89) were dissatisfied with the study design.

Conclusion: The data analysis was successfully completed and the patients reasons were identified and categorized into seven defined categories. The main reason for declining was no surplus of mental resources and it was mostly women who declined to participate. This study indicates that age also seems to be a reason for rejection. For further pharmacist intervention it is of great importance to be aware of the inclusion criteria, the timing concerning the acute phase of the admission in proportion to the illness situation and the communication form.

6-073

Category: General Clinical Practice

Title: Impact of student based patient counseling on Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) medication side effects metrics

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Purpose: The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey asks several questions about the education provided with new medications. The data from the HCAHPS is provided on publicly funded web-sites that allow the patients to compare different hospitals in their area and may also affect star ratings in the future. Pharmacy has a role in the improvement of the HCAHPS medication education metrics. The purpose of this project is to see if employing fourth year pharmacy students in patient counseling impacts the positive rating on the medication side effects questions on the HCAHPS survey.

Methods: Fourth year pharmacy students were assigned two nursing units to perform patient counseling based on an electronically generated trigger list. The trigger list was generated using the ALLSCRIPTS database utilized by our case management department. Patients diagnosed with pneumonia, myocardial infarction, and heart failure are included on the target list. If all patients were counseled on the trigger list, the students then counseled other patients on the two assigned nursing units. Data collected included percentage of patients on the trigger list counseled and the percentage that "Always" was answered on the HCAHPS medication side effects question. Statistical analysis was performed using GraphPad. A students t-test was used to compare means between the pre and post data and a Chi-Squared test was used to analyze the difference in the pharmacy department achieving the pre-specified goal of a 50% positive response to the side effects HCAHPS question. The pre-implementation was October 2013-May 2014 with post-implementation data June 2014-September 2014.

Results: Between June 2014 and September 2014 fourth year pharmacy students counseled 43.75% of patients that appeared on the electronically generated trigger list. The average positive HCAHPS Side Effects question was 37.78 pre-implementation and 51.15 post-implementation ($p=0.049$). After implementation, the pharmacy department achieved the set goal twice, while prior to implementation the goal had not been met ($p=0.04$).

Conclusion: This study concludes that by incorporating students into patient counseling a statistically significant improvement in the positive response to the HCAHPS side effects question and for the pharmacy department to meet pre-specified goals. It also identifies the

necessity of continued involvement by pharmacy students within the institution, as this program would not be able to capture the patients necessary without the students involvement. More data is required to ensure that this result continues in the long-term

6-074

Category: General Clinical Practice

Title: Management of the Necrotic Wound: A Systematic Approach Reduces Expense

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Purpose: Debridement is defined as the process of removing nonliving tissue from pressure ulcers, burns, and other wounds. Ascension Health was on track to spend in excess of 2 million dollars annually on enzymatic debridement agents. A price increase and product size change in collagenase ointment was estimated to attribute an additional 1.25 million dollars in procurement expense. An opportunity was identified to review the management of the necrotic wound and determine the place in therapy for collagenase ointment using clinical evidence.

Methods: An evidence based group of wound care specialists met over a four month period to review and grade the literature published for debridement agents. Therapeutic products assessed included collagenase (Santyl) and Active Leptospermum Honey (MediHoney). Recommendations from the workgroup included the following: 1) Follow a systematic approach to the management of necrotic would therapy, taking into consideration the wound-bed moisture and level of necrotic slough. 2) Recommend re-evaluation of the treatment plan for all necrotic wounds at least once weekly. If and when the necrotic area is significantly decreased, consider modification of treatment plan. 3) If treatment is ineffective with at least 2 weeks of treatment, consider a surgery consult for sharp debridement. The workgroup developed supportive material including a slide presentation summarizing the management of the necrotic wound and enzymatic debridement place in therapy, and an SBAR to provide additional background. This clinical initiative was formally approved through the Ascensions Therapeutic Affinity Group, and communicated to all health-system clinical leaders for comment over a 14 day period. Once all concerns were addressed, approval by the Clinical Executive Committee and Ascension CMO was obtained. Health-system sites were then given 90 days to implement the initiative.

Results: During the period from February 1, 2014 through May 31, 2015, there was a 60% reduction in the total number of grams of collagenase purchased, and a ten fold increase in the total amount of MediHoney grams purchased. This resulted in a 57% decrease in the expense per month from $264,000 to $114,000 for these two agents used to manage wound care.

Conclusion: Collaboration of an expert clinician group along with an established health-system review and communication process supported implementation of necrotic wound management. Enzymatic debridement therapy was recommended when indicated based on wound moisture

and slough. This resulted in decreased expense while providing care for the patient with a necrotic wound that is safe and effective.

6-075

Category: General Clinical Practice

Title: INDEED model: a pharmacist's approach to empathetic, patient-centered communication

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Purpose: There are several influencing factors that contribute to the method by which we as individuals communicate. Tailoring our healthcare approach for different communication patterns significantly impacts patient outcomes. In particular, empathetic communication training helps establish a robust patient-provider relationship resulting in improved quality measures. The INDEED model is an acronym used as a stepwise approach for facilitating empathetic, patient-centered communication. The acronym stands for the following: introduction, non-verbal, discover, employ empathy, and develop. This initiative was implemented throughout four affiliated hospital pharmacies in efforts to increase the amount of pharmacy personnel with formalized empathetic communication training.

Methods: Several principles were identified to have a direct influence intercommunication comprehension. These variables include differences in verbal and non-verbal interactions, variations in cultural insight, preemptive judgment, and differences in literacy comprehension. The INDEED model acronym was developed to target these variables. The model begins by identifying verbal and non-verbal miscommunication through a standard introduction and recognition of non-verbal cues. Afterwards, the provider gains easier access to discovering the patients needs, wants, and desires alleviating cultural, literary, or judgmental barriers. The provider can then employ empathy more readily resulting in a developed patient-provider relationship that promotes informed decision making, treatment adherence, and self-management. The INDEED model was taught through a two hour, interactive course holding up to eight voluntary participants. Learning techniques utilized included multimedia resources, interactive dialog in partner and group settings, use of various written materials, color coded graphical representations, and small group settings. An online voluntary survey collected two data points for this initiative. The first data point identified a need for the program by analyzing the number of individuals with previous empathetic communication training. The second data point confirmed the total number of trained individuals within the pharmacy department after the implementation of the INDEED model program.

Results: 68 pharmacy department members completed the voluntary survey. Of the total respondents, only seven members had received former empathetic communication training leaving 61 members in need of training. This need warranted the initiation of the INDEED model program. The program was implemented within four affiliated hospital pharmacy departments. Over a six month period of time, three INDEED model training sessions were completed. The number of individuals with formalized empathetic communication training increased to 19 according to survey results concluding an 18% increase of empathy trained pharmacy personnel within this health network.

Conclusion: Several factors, including empathetic communication, play a significant role in patient outcomes. Tailoring our healthcare approach and establishing robust patient-provider relationships can therefore improve quality measures. The INDEED model facilitates empathetic, patient-centered communication by utilizing a stepwise approach further promoting informed decision making, treatment adherence, and self-management. This program was implemented throughout four affiliated hospital pharmacies resulting in an increased number of individuals with formalized empathetic communication training. This highly adaptable program continues to be offered to all pharmacy department members and is also being promoted to other healthcare disciplines in efforts to make the INDEED model a network standard.

6-076

Category: I.V. Therapy / Infusion Devices

Title: Design and implementation of an introductory USP curricular module for P1 and P3 pharmacy students

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Purpose: Professional practice and accreditation standards require that students in the PharmD program develop knowledge and skills in the area of sterile compounding. In our school, students participate in extensive introductory pharmacy practice experiences (IPPE) and this provides most students, but not all, training in sterile compounding facilities. Our objective was to design and implement an introductory USP <797> curricular experience for all pharmacy students given limitations of lab space and class time.

Methods: Lab coordinators met with local experts in sterile compounding to design training for students in their first (P1) and third (P3) years. The same module was taught to both cohorts to speed up implementation. The module included a didactic lecture with a series of labs to develop technical skills. Each lab included pre-work (short reading and/or video that demonstrated techniques) and completion of a 5-question quiz before coming to the lab. Four lab sessions taught new skills and were graded pass/fail. The last 1 or 2 lab sessions were the practical assessment. P1 students had 1 week of practical and P3 students had 2, due to existing course structure. Additional personnel were required in each lab to teach/ assess skills, with most labs staffed by experienced pharmacy technicians. Skills included 1) hand washing, garbing, hood disinfecting; 2) Drawing up solutions, injecting into diluent bag; 3) Reconstituting powder, injecting into diluent bag; and 4) Manipulating ampules and filter needles, injecting into diluent bag. Post-training, questions about the module were added to a planned survey of P3 students. P1 students were not surveyed, but since this occurred prior to IPPEs, the cohort had relatively little experience in sterile compounding.

Results: One hundred thirty P3 students completed the module as part of a 0.5 SH Skills Lab Course. Ninety-seven (75%) responded to demographic survey questions. Of these, 29 (30%) reported no previous sterile compounding experience, 35 (36%) reported 1 semester or less of sterile products experience, 6 (6%) reported more than 1 semester of sterile products experience, and 27 (28%) reported currently working in sterile compounding. Mean scores on the pre-lab quizzes ranged from 41-49 out of 50 points. No student earned a failing score (<73%) on either practical. One hundred forty P1 students completed the module as part of the 0.5 SH Introduction to Pharmacy Practice Lab course. Mean scores on the pre-lab quizzes ranged from 32-48 out of 50 points. One student earned a failing score (<73%) on the practical. P3 survey data results

indicate 96% of students strongly agreed/agreed that lab content included relevant concepts and skills, 80% strongly agreed/agreed that the lecture content included relevant concepts and skills. 58% of students thought pre-lab materials sufficiently prepared them for the online quizzes and 70% thought the pre-lab materials sufficiently prepared them for the lab exercises. 82% felt the lab exercises prepared them for the practical.

Conclusion: Development and implementation of an introductory USP <797> curricular module increased exposure to this important content. Exercises and assessments were well received according to P3 students. Students in the P3 cohort performed better on the pre-lab quizzes, perhaps because of exposure during co-op/IPPEs. In future years, we plan to refine educational materials, create more detailed documents to describe techniques and work to improve student flow in the P1 course. Our successful implementation of this USP <797> curricular module in an existing, tight curriculum suggests such an approach might be considered by other programs.

6-077

Category: I.V. Therapy / Infusion Devices

Title: Improving drug library compliance with a smart infusion pump delivery system: a multidisciplinary approach

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Purpose: To improve the safety of administration of intravenous medications, the use of smart infusion pumps was implemented at a 244-bed full-service children's hospital and academic medical center in July 2009. An extensive drug library that provided alerts for incorrect doses, concentrations, and infusion times was created, but utilization of this library at the bedside was poor. A team of pharmacists, nurses, and administrators worked together to improve compliance and increase medication administration safety.

Methods: Discussion of the importance of utilizing the drug library began at the monthly pharmacy and therapeutics meeting with representatives from multiple disciplines and care areas. A plan for weekly compliance rounds was introduced and initiated by a small group of pharmacists. During compliance rounds, gaps in the drug library and inappropriate drug administration were identified, and real-time feedback regarding compliance was provided to the bedside nurse. Nurse educators began conducting more frequent compliance rounds and data was shared at the pharmacy and therapeutics meetings. Good catch data was also shared to provide support of the utility and impact of guardrail utilization. To further improve compliance, a report that identified the date and time of a basic infusion and the patient to whom it was administered was utilized. This report was distributed weekly to each patient care area and evaluated by the nurse educator. Any bedside nurse that administered a basic infusion was interviewed and the importance of guardrail utilization was reinforced. Gaps in the drug library were reported to the pharmacist team and the library was updated accordingly. All changes to the library and significant findings from the basic infusion reports were presented at the pharmacy and therapeutics meetings.

Results: Hospital-wide compliance with guardrail utilization at the time of smart infusion pump implementation was 10%. After three months of compliance rounds performed by pharmacists, compliance increased to 67%. With more frequent compliance rounds completed by nurse educators, compliance increased to 81% over a one year period. After the introduction of reports targeted at the identification of each basic infusion, compliance improved to 93% for the entire institution, with some care areas achieving 99% compliance.

Conclusion: Smart infusion pump technology provides an added level of safety for medication administration, but only if the drug library is used appropriately. Improving compliance is best achieved when nursing, pharmacy, and hospital administration work together to support and promote the process. Compliance walk rounds are a valuable method used to increase and sustain appropriate technology utilization by providing a necessary opportunity for real-time feedback and open discussion with the end user.

6-078

Category: I.V. Therapy / Infusion Devices

Title: Compatibility of isavuconazonium sulfate during simulated Y-site administration

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Purpose: Isavuconazonium sulfate is a prodrug of isavuconazole, a novel broad spectrum triazole recently approved for the treatment of invasive aspergillosis and mucormycosis. As patients with invasive fungal infections are often critically ill and may need to receive multiple intravenous drugs concomitantly, it is important to understand incompatibilities of intravenous drugs to avoid Y-site administration with isavuconazonium sulfate. We evaluated the physical compatibility of isavuconazonium sulfate with 86 drugs (29 antimicrobials and 57 other intravenous drugs) during simulated Y-site administration.

Methods: Isavuconazonium sulfate for injection was reconstituted according to the manufacturers recommendation and further diluted with 0.9% sodium chloride or 5% dextrose to a final concentration equivalent to 1.5 mg/mL of isavuconazonium sulfate. All other drugs were reconstituted and diluted with 0.9% sodium chloride and/or 5% dextrose per manufacturers recommendations to standard concentrations used clinically; ten drugs were tested in only one diluent. A Y-site was simulated in glass culture tubes by adding 5 mL of tested drug solution to 5 mL of isavuconazonium sulfate solution in each of the diluents; the order of mixing was also reversed in subsequent studies. All combinations were conducted in duplicate (4 observations total per combination) at room temperature and protected from light when required per manufacturers recommendations for tested drugs. Solutions were inspected for visual characteristics (i.e., clarity, color and tyndall effect) and turbidity (assessed by a laboratory grade turbidimeter) at pre-admixture, immediately upon admixture and at 15, 60, and 120 minutes post-admixture. For propofol, incompatibility was determined by the formation of a layer of free oil on top of the sample after centrifugation.

Results: Of 86 drugs tested, isavuconazonium sulfate was compatible with 57 drugs in tested solutions: amikacin, amiodarone, aztreonam, calcium chloride, calcium gluconate, caspofungin, ciprofloxacin, cisatracurium, daptomycin, dexmedetomidine, digoxin, diltiazem, diphenhydramine, dobutamine, dopamine , doripenem, doxycycline, epinephrine, eptifibatide, esmolol, famotidine, fentanyl, gentamicin, hydromorphone, imipenem/cilastatin, insulin human regular, labetalol, levofloxacin, lidocaine, linezolid, lorazepam, magnesium sulfate, mannitol, meperidine, mesna, midazolam, milrinone, morphine, mycophenolate mofetil, naloxone, neseritide, nicardipine, nitroglycerin, norepinephrine, octreotide, ondansetron, phenylephrine,

potassium chloride, ranitidine, rocuronium, sodium nitroprusside, tacrolimus, tigecycline, tobramycin, vancomycin, vasopressin and vecuronium. Incompatibility was observed when mixed with albumin, amphotericin B deoxycholate, liposomal amphotericin B, ampicillin/sulbactam, cefazolin, cefepime, ceftriaxone, cefuroxime, colistimethate sodium, dexamethasone (> 15 minutes only), ertapenem (> 15 minutes only), filgrastim, fosphenytoin, furosemide, heparin, meropenem, methylprednisolone, micafungin, pantoprazole (> 15 minutes only), phenytoin, potassium phosphate, propofol, sodium bicarbonate, and sodium phosphate in tested solutions. Additionally, azithromycin (>60 minutes only), bumetanide, ceftazidime (> 15 minutes only), and piperacillin/tazobactam were incompatible with isavuconazonium sulfate in 5% dextrose only. Ceftaroline (> 60 minutes only) was incompatible with isavuconazonium sulfate in 0.9% sodium chloride only. Incompatibilities included gross precipitation, positive tyndall effect, color changes, and/or increases in turbidity.

Conclusion: Of the 86 intravenous drugs evaluated, isavuconazonium sulfate at a concentration of 1.5 mg/mL was found to be incompatible with 15 antimicrobials, including most cephalosporins tested, and 14 other intravenous drugs in at least one of the two tested diluents. These data provide guidance when administering isavuconazonium sulfate via Y-site to patients concomitantly receiving other intravenous medications.

6-079

Category: I.V. Therapy / Infusion Devices

Title: Ceftolozane/tazobactam physical compatibility during simulated Y-site administration

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Purpose: Ceftolozane/tazobactam (Zerbaxa) is a novel β-lactam antibiotic of the cephalosporins class that has recently obtained approval for the treatment of complicated intra-abdominal infections in combination with metronidazole and complicated urinary tract infections including pyelonephritis. The objective of this study was to examine the physical compatibility of ceftolozane/tazobactam during simulated Y-site administration with frequently utilized intravenous medications.

Methods: Ceftolozane/tazobactam for injection was reconstituted according to the manufacturers recommendations and further diluted with 0.9% sodium chloride or 5% dextrose to a final concentration of 10/5 mg/mL. All other intravenous drugs were prepared according to manufacturers recommendations and diluted with 0.9% sodium chloride or 5% dextrose to standard concentrations used clinically. A Y-site administration was simulated by mixing 5 mL of ceftolozane/tazobactam solution with 5 mL of tested drug solutions in each of the diluents, switching the order of drug mixing. All combinations were conducted in duplicate at room temperature. Solutions were inspected for visual (i.e., color and Tyndall beam test), turbidity (assessed by a laboratory grade turbidimeter), and pH changes immediately, 15 minutes, 60 minutes, and 120 minutes after mixing. Incompatibility was defined as gross precipitation, color change, positive tyndall beam test, change in turbidity as measured by the turbidimeter of ≥ 0.5 or change in pH ≥1 unit during the 120-minute observation period.

Results: Ceftolozane/tazobactam is a clear, colorless solution after reconstitution and further dilution in 0.9% sodium chloride and 5% dextrose with an average pH of 5.5 in either diluent. Of the 37 intravenous drugs tested (16 antimicrobials and 21 other intravenous drugs), ceftolozane/tazobactam was compatible with 36 drugs in both tested solutions, these include amikacin sulfate, amiodarone, ampicillin/sulbactam, azithromycin, aztreonam, calcium chloride, calcium gluconate, cefazolin, cefepime, ceftazidime, ceftriaxone, cefuroxime, colistimethate sodium, dexmedetomidine, dobutamine, doripenem, doxycycline, epinephrine, fentanyl, heparin, hydrocortisone sodium succinate, hydromorphone, imipenem/cilastatin, insulin regular human, levofloxacin, lidocaine, lorazepam, mannitol, meperidine, methylprednisolone sodium succinate, metoclopramide, metronidazole, midazolam, morphine sulfate, nitroglycerin, and tedizolid phosphate. There were no substantial changes in pH observed with any tested combination over 120 minutes. Ceftolozane/tazobactam was incompatible with liposomal amphotericin B in 5% dextrose and cyclosporine in both diluents due to changes in turbidity which was observed immediately after mixing. In addition, the mixing of ceftolozane/tazobactam with phenytoin

sodium in 0.9% sodium chloride in either order resulted in an immediate precipitation and increase in turbidity.

Conclusion: Ceftolozane/tazobactam was shown to be compatible with metronidazole as well as 33 other commonly administered intravenous medications in both 0.9% sodium chloride and 5% dextrose. These data will be useful for pharmacists and nurses involved in the administration of ceftolozane/tazobactam to patients receiving other intravenous medications.

6-080

Category: I.V. Therapy / Infusion Devices

Title: Smart pump alerts: establishing benchmarks and identifying opportunities to reduce alert fatigue

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Purpose: Smart pump alerts provide safety warnings when attempting to program outside dosing limits, but can contribute to alert fatigue and drug library workarounds. Improving drug library use and reducing alerts and associated fatigue are key initiatives for healthcare providers. However, current research does not provide benchmarks on overall incidence of alerts or guidance on key areas to target to reduce non-credible alerts and optimize drug library use. We sought to quantify the incidence and type of drug library alerts and identify key practice trends contributing to these alerts.

Methods: A retrospective analysis of drug library alert data was conducted using a national database of hospitals using our infusion management software. The dataset included 4,127,601 therapies across 50 hospitals using 25,485 smart pumps. The hospitals ranged in size from 25 to 1000 beds using 2 different infusion pump platforms on adult and pediatric populations. Five of the hospital datasets included syringe pump data. Data was first analyzed to quantify alert incidence per therapy, the response to alerts (override versus correction), the incidence of dose corrections and the top drug therapies causing alerts. Next, the alert responses were analyzed to identify key practice trends contributing to alerts. The database had detailed alert response information, including programming sequence surrounding each alert to provide insight into clinical practice. The alert data was then reviewed against hospital drug library parameters and resultant improvement to alerts after drug library changes were made.

Results: The incidence of alerts per therapy was 1% (59,226 alerts across 4,127,601 therapies). Response to alerts was 91% overrides (53,761) and 9% corrections (5,465). The overall correction rate was 0.1% (5,465 corrections across 4,127,601 therapies), representing 1 dose correction for every 1000 therapies. The top drug therapies causing alerts were identified based on total number of alerts and frequency in the top 10 across hospitals. The top 10 therapies were propofol, heparin, oxytocin, insulin, dopamine, norepinephrine, vasopressin, amiodarone, magnesium sulfate and fentanyl. The analysis revealed three key trends contributing to these alerts. The first was hospital specific protocols for titrated therapies not aligning with clinical practice. When propofol, fentanyl, dopamine and insulin soft minimum and maximum limits were not aligned with titration practices, this resulted in higher override rates when titrating to support care. The second trend was the creation of multiple entries, preparations and parameters for a single drug. Multiple entries for heparin, oxytocin, vasopressin, amiodarone and

magnesium sulfate resulted in higher alert rates due to selection error and workarounds. The third trend was bolus dosing by increasing the infusion rate. This practice was evident with propofol, fentanyl, dopamine, norepinephrine and insulin when the bolus feature wasnt activated/consistently used.

Conclusion: Establishing benchmarks on the incidence and type of smart pump alerts is an important first step in reducing alert fatigue and optimizing drug library use. This study revealed an overall low incidence of alerts and dose corrections indicating a low incidence of programming error - and key therapies and practices causing overrides and workarounds. Hospitals can use this data to help target key infusions, compare against benchmarks and optimize drug library use. While the dataset included more than 4 million infusions, it was a non-randomized sample of 50 hospitals using only 2 types of infusion pump platforms.

6-081

Category: Infectious Diseases

Title: Assessing the uptake and timeliness of an antibiotic stewardship model using interrupt email as the primary communication tool in prospective auditing of antimicrobial use

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Purpose: At Bellevue Hospital Center, formulary restriction of antimicrobials and prospective audit with intervention and feedback are employed by the Antibiotic Stewardship Program (ASP). Several antimicrobials require pre-authorization by infectious disease physicians while other antibiotics undergo an audit 72 hours after initiation. The ASP utilizes the interrupt email function in the electronic medical record (EMR) as the primary communication tool with multiple providers. This alerts providers that they have received an urgent email. The purpose of this study was to evaluate the uptake and timeliness of an ASP model using this method of communication in prospective auditing of antimicrobial use.

Methods: An infectious disease trained pharmacist and an infectious disease attending physician reviewed all piperacillin-tazobactam and cefepime orders 72 hours after initiation of therapy from January 1, 2015 to May 31, 2015. Orders scheduled for review on weekends were reviewed on the next business day. Patients with an infectious diseases consultation were exempt from review. If changes in therapy for piperacillin-tazobactam, cefepime, or other antibiotics were merited, an interrupt email was sent to the patients resident and attending physician using the hospitals EMR/computerized physician order entry system (QuadraMed). Data were collected and analyzed monthly. The time frame from ASP intervention to antibiotic order change (24 hours or 48 hours) was evaluated. For the purpose of this study, orders changed after 48 hours were considered not accepted.

Results: During this time period there were a total of 272 antibiotic interventions. The acceptance rate (suggested changes made within 48 hours) was 84% (229/272). Seventy-two percent (195/272) were accepted within 24 hours. The types of interventions were: discontinue therapy 73% (199/272), alternative therapy 21% (58/272), and others 6% (15/272). Eighty-eight percent (146/166) of accepted interventions to discontinue therapy and 90% (44/49) of accepted interventions for alternative therapy occurred within 24 hours. The antibiotics requiring the most frequent interventions were vancomycin (43%), cefepime (29%), piperacillin-tazobactam (15%) and azithromycin (4%). The percentage of accepted recommendations occurring within 24 hours for antibiotics was vancomycin 87% (85/98), cefepime 85% (57/67), piperacillin-tazobactam 91% (31/34), azithromycin 88% (7/8), and others 82% (18/22).

Conclusion: Overall, 84% of antibiotic stewardship interventions were accepted within 48 hours and 72% within 24 hours. Acceptance rate and timing of antibiotic did not vary by intervention type or antibiotic. Prospective auditing with intervention and feedback utilizing interrupt email as a major mode of communication is an effective technique for an ASP.

6-082

Category: Infectious Diseases

Title: Piperacillin-tazobactam extended infusion impact on Pseudomonas aeruginosa susceptibility at a community hospital.

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Purpose: It is well known that infections caused by antimicrobial resistant organisms are difficult to treat. They lead to increased length of stay, morbidity, and cost. Treatment options are limited. Beta-lactamase inhibitors, such as piperacillin-tazobactam, have time-dependent pharmacodynamic properties, which can be used to potentiate the bactericidal killing effect. Bactericidal action is maximized when the free drug concentration (fT) is above the minimum inhibitory concentration (MIC) of the organism for forty to sixty percent of the dosing interval. Extending the administration infusion time helps achieve this target (fT>40-60%MIC).

Methods: Piperacillin-tazobactam was widely used in the hospital for inpatient empiric treatment as well as for outpatient short-stay treatment in the emergency room. Antibiotic streamlining was poorly practiced by our physicians and utilization of the broad spectrum antibiotic became extremely high. In 2010, piperacillin-tazobactam purchases accounted a thirty five percent of the antibiotic drug spend. Antibiograms from years 2007 to 2010 were analyzed and compared. A resistance pattern was detected for the organism Pseudomonas aeruginosa. Susceptibility of Pseudomonas aeruginosa to piperacillin-tazobactam had decreased nineteen percent in three years. In November 2010, a piperacillin-tazobactam extended infusion program was implemented. Piperacillin-tazobactam was removed from the emergency room stock and was restricted to empirically treat patients with a high suspicion of Pseudomonas aeruginosa infection. Streamlining was promoted when culture and sensitivity report were available. Physician education was offered as oral and written clinical interventions. IV pump inventory was done to guarantee the exact infusion rate required for the extended infusion. Nursing and pharmacy departments were educated about the following extended infusion details: proper dilution, stability, incompatibilities and administration hours. Because automatic interchange was not approved, recommendations to change from intermittent to extended.

Results: The initial acceptance percentage was seventy percent and reached eighty percent by the end of 2011. Purchases were reduced by forty three percent six months after implementation of the clinical initiative. Most physicians were ordering the extended infusion without pharmacy recommendation after a year. Currently, eighty-five to ninety percent of physicians order the extended infusion without pharmacy intervention. Due to incompatibility issues between piperacillin-tazobactam and concomitant antibiotics some patients continue to receive the traditional intermittent infusion. Antibiograms are generated by the microbiology department bi-annually. Data is collected from the software from January to June and from July to December.

Since the initiative was implemented in November 2010, the impact of the initiative was evaluated in July 2011. The antibiogram from January to June 2011 revealed an increase of eighteen percent in Pseudomonas aeruginosa susceptibility to piperacillin-tazobactam. The extended infusion has helped increase the susceptibility to eighty percent. Piperacillin-tazobactam susceptibility reports were interrupted for almost a year. The lab vendor used in the hospital reported a recall of the disk in 2011. The problem was resolved late 2012. Piperacillin-tazobactam susceptibility reporting was re-established by 2013. By 2014, Pseudomas aeruginosa susceptibility to piperacillin-tazobactam was ninety-five percent.

Conclusion: Extended infusion of piperacillin-tazobactam in combination with appropriate utilization of broad spectrum antibiotics can result in positive outcomes improving susceptibility for multidrug resistant organisms.

6-084

Category: Infectious Diseases

Title: First documented allergic reaction to ombitasvir/paritaprevir/ritonavir and dasabuvir combination therapy for hepatitis c virus

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Case Report: Recent advances in therapies for hepatitis c virus (HCV) have drastically changed how the disease is managed. More patients seek treatment due to increase efficacy and tolerability. Discontinuation rates due to severe adverse effects have become extremely rare. Ombitasavir/paritaprevir/ritonavir with dasabuvir (3D), collectively marketed under the trade name Viekira pak, is indicated for the treatment of HCV with or without ribavirin for 12 or 24 weeks depending upon HCV genotype and presence of cirrhosis. In published trials, no patients experienced hypersensitivity to any component of therapy. This report describes 3D- induced arthralgia, edema, and extreme pruritus in a non-cirrhotic 66 year old white female with genotype 1b HCV. Twelve weeks of 3D therapy without ribavirin were initially prescribed. Pertinent past medical history includes vasculitis, cryoglobulinemia, stage 3 chronic kidney disease, and hypertension. Prior to therapy initiation, the patient was taking stable doses of labetalol, losartan, ergocalciferol, and prednisone. No pertinent drug-drug interactions were identified. One week after starting 3D therapy, the patient complained of generalized joint pain, which is not a listed adverse effect of therapy in the package label. No edema or pruritus was noted at this time and range of motion was not significantly impaired. The patient was advised to continue therapy and take acetaminophen as needed for joint pain. The patient then noted bilateral hand swelling within hours of taking her antiviral medication in the morning and was unable to hold onto her steering wheel. Swelling soon developed in patients knees and elbows in addition to her hands. Concurrently she noted extreme itching and stated she would scratch until red welts appeared. At this time her gastroenterologist discontinued 3D antiviral therapy. Edema and arthralgia symptoms resolved 2 days after cessation of therapy and pruritus resolved 5 days after stopping therapy. HCV therapy has since been changed to ledipasvir/sofosbuvir for twelve weeks without complication. This is the first documented case of discontinuation of 3D therapy due to adverse drug reactions in a genotype 1b patient. A MedWatch report was submitted to the FDA. Judicious monitoring of adverse drug effects and participation in post-marketing surveillance is imperative for the newly approved DAAs.

6-085

Category: Infectious Diseases

Title: Economic impact of an antimicrobial stewardship program in the first year

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Purpose: Antimicrobial stewardship aims to optimize clinical outcomes through a variety of interventions. In many cases, these initiatives lead to lower medication costs in the early phase of the program. This review quantifies the impact of an antimicrobial stewardship program on medication costs in the first year at a 222 bed hospital.

Methods: The antimicrobial stewardship program began in May 2014 after a 12 month pilot and education program. The program targeted 6 antimicrobials in the inpatient setting: meropenem, ertapenem, tigecycline, vancomycin, linezolid and daptomycin. Medication purchase history was reviewed from May 2013 through April 2015. Acquisition costs in the pilot phase (May 2013-April 2014) were compared to the 1st year of the program (May 2014-April 2015). Defined daily dose (DDD) was calculated by the sum of grams purchased for each target antimicrobial divided by the DDD according to the World Health Organization. Cost per patient day was utilized to volume adjust costs. Pharmacist interventions and acceptance rate were recorded.

Results: Spending on antimicrobials accounted for 6.2 percent of total inpatient drug spend in the first year of the program, down from 7.7 percent in the previous year. Acquisition costs for all antimicrobials decreased by 467,123 dollars or 38 percent in the first year compared to the previous year. Likewise, acquisition costs for target antimicrobials decreased 440,921 dollars or 49 percent for the same time period. Cost per patient day decreased by 10.91 dollars for all antimicrobials and 9.27 dollars for target antimicrobials in the first year. Of the target antimicrobials, daptomycin accounted for the majority of the savings with a decrease of 329,488 dollars or 52 percent in the first year. The quantity of daptomycin vials purchased decreased similarly by 57 percent. The DDD per 100 patient days for daptomycin decreased from 7.5 to 3 during the first year. The pharmacist made an average of 22.9 recommendations per month and 81.5 percent were accepted.

Conclusion: Savings of 440,921 dollars occurred during the first year of the program. These savings represent 3.6 percent of total drug spending. The majority of these savings resulted from decreased inpatient use of daptomycin, which was a goal of the program. Recommendations from the pharmacist were accepted at a rate of 81.5 percent, indicating the value of a pharmacist in this program. Limitations include lack of utilization data and days of therapy, which may be

more accurate than purchase history and defined daily doses. Outcomes data such as resistance patterns were not available. Future directions include tracking of antibiotic resistance.

6-086

Category: Infectious Diseases

Title: Subjects with Renal Impairment Switching from Tenofovir Disoproxil Fumarate to Tenofovir Alafenamide Have Improved Renal and Bone Safety through 48 Weeks

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Purpose: Tenofovir (TFV) is renally eliminated, and the prodrug, tenofovir disoproxil fumarate (TDF) has been associated with renal toxicity and reduced bone mineral density (BMD). Tenofovir alafenamide (TAF) is a novel prodrug of tenofovir (TFV) that results in 90% lower plasma TFV levels as compared to TDF. The safety and efficacy of a once-daily single tablet regimen of elvitegravir, cobicistat, emtricitabine, and TAF (E/C/F/TAF) was assessed in HIV-1 infected patients with mild to moderate renal impairment.

Methods: Virologically suppressed adults with stable renal impairment (eGFRCG 30 to 69 mL/min) had their treatment switched from both TDF- and non-TDF-containing regimens to open-label E/C/F/TAF. Week 48 safety data by pre-switch TDF use are presented.

Results: Of 242 subjects switched to E/C/F/TAF [mean age 58 years (range: 24 82), 18% Black, 39% HTN, and 14% DM] 158 subjects (65%) were taking TDF-containing regimens prior to switch. At Week 48, the median (Q1, Q3) change from baseline for eGFRC-G was +0.2 (-5.8, 6.3) mL/min ($p=0.81$) and for eGFR-cystatin C was +2.7 (-6.2, 14.1) mL/min/1.73m2 ($p=0.003$). The following measures of renal tubular function improved significantly ($p<0.001$ for all) for subjects switching from TDF-containing regimens to E/C/F/TAF: quantified proteinuria (UPCR, median [Q1, Q3] % change; -55 [-70, -28]), albuminuria (UACR, median [Q1, Q3] % change; -61 [-81, -27]), retinol binding protein (RBP:Cr, median [Q1, Q3] % change; -82 [-95, -55]), and beta-2-microglobulin (β-2-microglobulin:Cr, median [Q1, Q3] % change; -89 [-97, -61]). The prevalence of clinically significant proteinuria (UPCR > 200 mg/g) and albuminuria (UACR ≥ 30 mg/g) decreased from 48% to 13% and from 56% to 22%, respectively. Significant increases in mean % change in hip (+1.29%) and spine (+2.60%) BMD were observed at 48 weeks ($p<0.001$ for both). Subjects taking non-TDF based regimens pre-switch (n=84) had no significant changes from baseline measures of renal function or BMD.

Conclusion: Subjects with mild and moderate renal impairment (eGFR 30 to 69 mL/min) who switched from TDF-containing regimens to once daily single-tablet E/C/F/TAF experienced improvements in multiple assessments of renal and bone safety through 48 weeks. These data support the safety of E/C/F/TAF in patients with impaired renal function.

6-087

Category: Infectious Diseases

Title: Impact of Point of Care Screening for Chlamydia and Gonorrhea on Antimicrobial Stewardship in the Emergency Department

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Purpose: Traditional screening methods for chlamydia and gonorrhea (CT/NG) may require up to five days for results. This delay impacts the time to notification and treatment for test-positive patients who do not receive empiric therapy. Meanwhile, it also results in unnecessary antimicrobial use in test-negative patients. The purpose of this investigation was to determine if implementation of a new point-of-care (POC) screening test in a community Emergency Department (ED) improved CT/NG treatment appropriateness by decreasing antimicrobial exposure in test-negative patients while increasing treatment rate in test-positive patients.

Methods: A retrospective quasi-experimental study was conducted of patients 15 years of age who received traditional vs. POC CT/NG screening in the ED between December 2013-January 2014 (traditional group) and December 2014-January 2015 (POC group). Patients who were screened at a satellite ED or urgent care facility, required inpatient admission, or were diagnosed with pelvic inflammatory disease were excluded. Data collected included patient characteristics, screening characteristics, antimicrobial therapy, and clinical outcomes. Groups were compared based on receipt of appropriate antimicrobial treatment, time to notification of positive result, time to appropriate treatment, and ED length of stay.

Results: Four hundred patients were included, 200 in the traditional group and 200 in the POC group. Demographics were similar between groups. There was an 11.5% increase in treatment appropriateness in the POC group compared to the traditional group, 61% vs. 72.5%, (p=0.015). In the POC group, 40 patients (20%) were provided test results prior to discharge from the ED, with 97.5% treated appropriately. Median time to patient notification was significantly shortened in the POC group when compared to the traditional group, 18.6 hr (0.3 C 234.0) vs. 51.5 hr (26.7 C 79.9), (p=0.008). There was no difference in ED length of stay between groups.

Conclusion: Implementation of ED POC screening for CT/NG was associated with a significant increase in appropriate antimicrobial utilization as well as decreased time to notification of

positive results. These results support the use of POC CT/NG screening to promote antimicrobial stewardship efforts within the ED.

6-088

Category: Infectious Diseases

Title: Drug utilization evaluation of vancomycin in a community hospital

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Purpose: Antimicrobial resistance has become a critical healthcare issue in both inpatient and outpatient settings. The selection of resistant organisms is due in great part to the indiscriminate and inappropriate use of antibiotics, which has led to national calls for the development of antimicrobial stewardship programs. One commonly and inappropriately-used antibiotic in the hospital setting is vancomycin (VANC). The purpose of this study was to review the utilization and dosing strategies for VANC in a community hospital without a stewardship program. Ultimately, these data will be utilized to convince hospital administrators and physicians to support a pharmacy-managed stewardship program.

Methods: This project was approved by the administration of the hospital and deemed to be exempt by the University's institutional review board. Forty randomly-selected patients who were initiated on VANC therapy between July and December, 2014 were included in the study population. Inclusion criteria included adults who were 18 years of age or older and who received VANC therapy for at least 72 hours. Of the original 50 patients screened, 40 met the inclusion criteria. The electronic medical record (EMR) of each patient was systematically reviewed for basic demographic information, indication for the use of VANC, the percentage of patients who had VANC therapy discontinued during their hospital stay, duration of VANC administration, the percentage of patients who achieved a goal VANC concentration at the time of the first serum concentration, the time to the first therapeutic trough concentration, and changes in serum creatinine concentrations during VANC therapy.

Results: Based on previously published and well-accepted drug-use guidelines, VANC usage was determined to be appropriate in 22 patients (55%) and was determined to be questionable or inappropriate in 18 patients (45%). In 17 patients (42.5%), VANC was used as part of a combination therapy regimen for the treatment of proven or suspected healthcare-associated pneumonia (HCAP). The primary reason for hospital admission was an infection in 23 patients (57.5%) and 12 patients (30%) had VANC discontinued during the hospital stay based on either culture results or clinical improvement. VANC serum concentrations were reported in 31 patients (77.5%); but, only 14 patients (35%) demonstrated a goal serum concentration (15 mcg/mL or greater) with the first serum concentration. A total of 18 patients (45%) achieved a goal serum concentration at some point during the hospital stay. Three patients experienced a sustained increase in serum creatinine of more than 0.3 mg/dL during VANC therapy; but, 20 patients (50%) experienced a sustained decrease in serum creatinine of more than 0.3 mg/dL.

The mean serum creatinine concentration upon admission was 1.49 mg/dL for this cohort of patients.

Conclusion: Almost one-half of patients initiated on VANC did not have a clear indication for its use, although therapy was discontinued appropriately in 30% of these patients. HCAP is a major contributor to the use of VANC in this hospital population. Initial VANC dosing strategies did not result in the targeted serum concentration in the majority of patients. Many more patients experienced a decrease in serum creatinine concentrations than those who experienced a sustained increase. These data are currently being utilized to develop an antimicrobial stewardship program, including improved initial VANC dosing methodologies, within the hospital.

6-089

Category: Infectious Diseases

Title: Retrospective analysis of antibiotic usage in a community hospital

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Purpose: The inappropriate use of antibiotics is an ongoing problem and may include up to 50% of antibiotics used in hospital settings. This results in higher rates of adverse events, antimicrobial resistance, morbidity, mortality, and healthcare costs. The CDC recommends that hospitals institute antimicrobial stewardship programs (ASPs) to optimize the use of antibiotics and slow the progression of antimicrobial resistance. The purpose of this study was to retrospectively review the appropriateness of antibiotic use in a community hospital without an established ASP. This information will be utilized to gain support for development of an ASP within the hospital.

Methods: This project was approved by the administration of the hospital and deemed to be exempt by the University's institutional review board. Thirty randomly-selected patients who were initiated on intravenous antibiotic therapy between December, 2013 and August, 2014 were included in the study population. Inclusion criteria included a length of stay of more than 3 days and treatment with piperacillin-tazobactam, a 3rd- or 4th-generation cephalosporin, levofloxacin, or a carbapenem. The electronic medical record of each patient was systematically reviewed for demographic information, past medical history, reason for admission, selected laboratory values, length of stay, appropriateness of both initial antibiotic choice and dose, and the appropriateness of response to culture and sensitivity (C&S) information. Each physician and pharmacist note was carefully reviewed to identify justification for both the antibiotic selected and initial dosing decision. This information was then utilized to assess the appropriateness of antimicrobial therapy in conjunction with established guidelines and to develop specific "talking points" and clinical examples to support the establishment of an ASP within the institution. Additionally, an education effort to improve initial antimicrobial dosing focused toward the hospital pharmacists has been developed from these study data.

Results: Approximately 50% of these patients were hospitalized between 6 and 10 days and the most commonly prescribed antibiotics were levofloxacin (53.3% of patients), piperacillin-tazobactam (46.7%), and vancomycin (36.7%). Overall, a total of 11 different antibiotics were prescribed to these 30 patients; but, no other antibiotic was used in more than 6 (20%) patients. Although levofloxacin was used in more patients (16 vs 14), piperacillin-tazobactam accounted for more patient-days of antibiotic therapy (87 vs 80). Physicians were more likely to discontinue

levofloxacin during hospitalization than piperacillin-tazobactam. Following a careful analysis of indications for antibiotic usage, including initial WBC count, presence of a left-shift, presence or absence of fever, clinical symptoms, diagnostic tests (as applicable), and procalcitonin concentrations, 57% of these patients had a clear indication for antibiotic use, 30% had no clear indication for antibiotic use, and in 4 patients (13%) it was not possible to make a clear determination. Based upon the indication for antibiotic therapy and established guidelines, initial therapy was determined to be inappropriately broad in seven of the 17 patients with a clear indication for therapy. Thus, in only 10 patients (33.3%) was the initial antibiotic choice both indicated and appropriate.

Conclusion: Almost one-half of patients initiated on intravenous antimicrobial therapy in a community hospital without an ASP did not have a clear indication for use. Furthermore, in about 40% of the patients with an indication for antibiotics, the agent selected was inappropriate based on current clinical guidelines. These results demonstrate a need for establishment of an ASP within the hospital and this information will be presented to the P&T Committee. This information has also been utilized to prepare a series of educational materials for hospital pharmacists in preparation for participation within the ASP.

6-090

Category: Infectious Diseases

Title: Real-world evidence of longer and recurrent treatment episodes associated with obesity in patients hospitalized with acute bacterial skin and skin-structure infections (ABSSSI)

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Purpose: Persistent ABSSSI symptoms, antibiotic treatment, and medical resource utilization (MRU) extend episodes of ABSSSI treatment, contributing to the growing burden of ABSSSI. Challenges in curing ABSSSI have been linked with obesity. However, there is limited real-world evidence of the duration and recurrence of ABSSSI treatment episodes and their association with obesity. This study aimed to characterize ABSSSI treatment episodes and compare their duration and recurrence between obese and non-obese patients.

Methods: A longitudinal study was conducted utilizing IMS Pharmetrics PlusTM/ambulatory electronic medical records (EMR) database (2009-2014), one of the largest integrated claims/EMR databases. Adult patients were included if they were hospitalized with ABSSSI, continuously enrolled in medical and prescription drug plans, and followed for 150 days after discharge. ABSSSI treatment episodes were identified. An episode started with the first inpatient ABSSSI diagnosis (index date) and ended with the last date of ABSSSI-related MRU (outpatient visit or hospitalization) or last date of ABSSSI-indicated antibiotic on hand (whichever was later) followed by 60 consecutive days with no further ABSSSI MRU or antibiotic. To ensure analyzed episodes comprised new infections, episodes in which an antibiotic fill or an ABSSSI diagnosis was observed prior to the index date were excluded from the analysis. ABSSSI treatment episodes were categorized into obese and non-obese groups based on BMI. Episode duration was stratified into 30-day ranges. Recurrence was defined by the observation of an ABSSSI inpatient stay after the 60-day gap used to define the end of the initial episode. Episode duration and recurrence were compared between obese and non-obese groups.

Results: 181,252 patients were selected, with 56% male and a mean age of 52 years. Among those with available BMI records (N=11,986, 7%), 53% of patients were obese (BMI≥30 kg/m2). Compared with non-obese patients, obese patients were 29% less likely to be older than 65 years, 6% more likely to have combined abscess and cellulitis infections, and 14% less likely to have a surgical wound infection (all $p<0.001$). A total of 199,157 treatment episodes were identified among selected patients. The average patient had 1.1 treatment episodes and the frequency of episodes increased with BMI. Compared with non-obese patients, obese patients were 35% more likely to experience a recurrent ABSSSI episode (OR=1.35, $p<0.001$). The average ABSSSI episode lasted for 36 days, with 64% of episodes ending within 30 days, 17%

between 30 to 60 days, 8% between 60 to 90 days, and 11% extending past 90 days. Compared with non-obese patients, treatment episodes for obese patients lasted 4.2 days longer ($p<0.001$). Treatment episodes for obese patients were 15% less likely to end within 30 days (OR=0.85, $p<0.001$). In particular, obese patients were 26% more likely to experience ongoing ABSSSI-related MRU or medication utilization for longer than 90 days (OR=1.26, $p<0.001$).

Conclusion: This study demonstrated the real-world challenges of treating ABSSSI among obese patients. Results suggested a strong association between obesity, longer ABSSSI treatment episodes, and recurrence of ABSSSI. The likelihood of an episode of ABSSSI ending within a short timeframe is significantly lower among obese patients compared with non-obese patients. More effective antibiotic therapy is needed for obese ABSSSI patients in particular.

6-091

Category: Infectious Diseases

Title: Assessment of meningitis treatment among Lebanese hospitalized patients

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Purpose: Meningitis is a common worldwide disease affecting the meninges; it is usually due to the infection of the fluid surrounding the central nervous system after dissemination of microorganisms. Over 1.2 million cases of bacterial meningitis are estimated to occur worldwide each year. But for the aseptic meningitis there is no exact incidence report till now. It is a rare but life threatening condition so immediate diagnosis and treatment are warranted. In general meningitis treatment requires antibiotics or only supportive therapy depending on the meningitis type. This study was conducted to review and evaluate meningitis treatment in Lebanese hospitals.

Methods: The study was a retrospective descriptive study conducted at four Lebanese hospitals after the approval of the Institutional Review Board. All patients diagnosed with meningitis between 2008 and 2014 were screened for possible enrollment in the study and excluded if they were immunocompromised or long term users of corticosteroids. Patient demographics, past medical history, present active problems, vaccination history, signs and symptoms, microbiologic laboratory results, and cerebrospinal fluid results were obtained from the medical records. Descriptive analysis as frequencies and percentages were used appropriately to evaluate the results. The threshold of statistical significance was set at P value less than 0.05. Statistical analyses were performed using software package used for statistical analysis version 22.

Results: Records of 280 patients admitted to the hospitals with meningitis symptoms were screened for possible enrollment in the study. From these patients, 168(60%) were diagnosed with viral meningitis and 112(40%) with bacterial meningitis which was confirmed using laboratory results. For the viral diagnosed patients, 128(76.2%) remained on the initial prescribed antibiotics despite the negative culture results. For the bacterial meningitis patients, 77(68.8%) received incompatible treatment regimen with the Infectious Diseases Society of America. The reason for the treatment incompatibility were, 103(92%) for drug therapy, 79(70.6%) for drug dose, 67(59.8%) for route of administration and 48(42.9%) for duration of therapy.

Conclusion: According to this retrospective study, there was a high percentage of patients receiving inappropriate meningitis treatment in Lebanese hospitals. Despite the adoption of the international guidelines for meningitis treatment for all age group, yet the clinical application is

hindered in some of the Lebanese hospitals. There is a malpractice among the hospitals in which doctors continue to prescribe antibiotics even after viral meningitis confirmation. As a conclusion, meningitis is a life threatening disease where the prevention is a vital strategy in minimizing the neurological complications in high risk patients.

6-092

Category: Infectious Diseases

Title: Evaluation of meningitis complications in Lebanese hospitalized patients

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Purpose: Meningitis is the inflammation of the protective membrane covering the brain and the spinal cord known as the meninges. It is a medical emergency that requires immediate attention. Any delay in the treatment will increase the incidence of systemic and neurologic complications. Systemic complications manifested as septic shock, respiratory failure or organ dysfunction and neurologic complications manifested as brain damage, seizure or hearing loss. The objective of this study is to evaluate the variables that increase the risk of complications among patients with meningitis.

Methods: This was a retrospective descriptive study screening all patients in four different Lebanese hospitals who developed meningitis between 2008 and 2014. Data was retrieved from the medical records that were either documented or computerized. The Institutional Review Board from all involved hospitals approved this study. All patients diagnosed with meningitis between 2008 and 2014 were screened for possible enrollment in this study. However, patients with immunocompromised diseases, long term use of corticosteroids or other immunosuppressive drugs were excluded. A data collection sheet was used to collect all needed information about patient demographics, past medical history, present medical problems, vaccination history, signs and symptoms, microbiologic laboratory results, and cerebrospinal fluid results. Chi square test and logistic regression were used appropriately to report the results using the two sided p-value with the alpha set at a significance of 0.05.

Results: A total of 280 patients diagnosed with meningitis were screened for possible enrollment in the study. From these, 168 (60%) were diagnosed with viral meningitis and 112 (40%) with bacterial. For the viral meningitis patients, 60 (35.7%) developed complications at discharge compared with 45 (40.2%) with bacterial. The variables that were studied to assess the association for the complications development were age, gender, tobacco history, alcohol consumption and overall treatment compatibility with the Infectious Diseases Society of America. Analysis found no significant association for all variables except for age and overall treatment compatibility with the Infectious Diseases Society of America guidelines. For the age, the significant association was documented for both types of meningitis with a p value of 0.001. The risk for complications was the highest in elderly with an incidence of 69% versus 37.2% in adults. However for the overall treatment compatibility with the Infectious Diseases Society of America guidelines, the significant association was also documented for viral and bacterial

meningitis with p values of 0.02 and 0.005 respectively. The most commonly encountered complication in both types of meningitis was seizure.

Conclusion: The results of this study showed that patients who develop meningitis are at high risk for neurologic sequelae development and lifelong impairment. There are many factors that can increase the risk of developing complications which are related to the patient characteristics and choice of the therapy. The findings of this study showed that there is a significant impact on complications development between age and treatment compatibility. As a conclusion, it is very important to tackle the right treatment regimen in terms of drug, dose, route of administration and duration of therapy in order to decrease the complications development.

6-093

Category: Infectious Diseases

Title: Adult pneumococcal immunization programs a multi-center assessment of diverse practice sites in the United States

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Purpose: In 2012, the Advisory Committee on Immunization Practices (ACIP) recommended the 13-valent pneumococcal conjugate vaccine (PCV13) for individuals aged 19 and older with immunocompromising conditions. Pharmacists are often involved in translating national recommendations for institutional immunization policies and guidelines. The complexity of ACIP recommendations leaves room for interpretation and variability in practice. However, the extent to which variability exists in pneumococcal vaccination policies and guidelines has not been evaluated. This study assessed whether institutional pneumococcal immunization protocols and guidelines exist and whether these guidelines were consistent with ACIP or other recommendations in diverse clinical settings in the United States.

Methods: This was a multicenter, cross-sectional survey of pharmacist members of the American College of Clinical Pharmacy Practice-based Research Network (ACCP PBRN). Participants had to 1) be enrolled as ACCP PBRN members; 2) engage adult population likely to require pneumococcal vaccine; 3) and practice in a site with a pneumococcal immunization guideline, pathway, or protocol. Practitioners whose practice involved only childrens hospital or medical centers, international travel clinics, or vaccine clinics were excluded. Participants identified the existence or absence of pneumococcal immunization policies or guidelines and collected information regarding institutional operational/system, support/resource, and barriers to implementing pneumococcal immunization guidelines in their practice setting. Data included pneumococcal immunization policies, order and administration format, and the pharmacist participants perception of barriers to pneumococcal immunization. Data were collected using REDCap (Vanderbilt University, Nashville, TN). Data were analyzed using descriptive statistics, stratified by inpatient or outpatient setting using IBM SPSS Statistics v.22 (IBM Corp, Armonk, NY).

Results: 61 sites were included in the analysis, with 56 inpatient and 38 outpatient sites pneumococcal immunization policies and guidelines evaluated. Inpatient sites were in multi-site health systems (73.2%) or integrated delivery networks (60.7%), teaching (83.3%), and private non-profit (63.0%), with median (quartiles) census of 300 (209, 450). Outpatient sites were in multi-site health systems (60.5%) or integrated delivery networks (57.9%), teaching (88.9%),

and private non-profit (57.9%). Outpatient sites were hospital-based academic (63.2%), non-academic (13.2%), and community health centers (10.5%). 45/56 (80.4%) inpatient hospital sites had required written policies or formal guidelines. 43/45 (95.6%) policies/guidelines were based on the ACIP recommendations, 8/45 (17.8%) Infectious Diseases Society of America (IDSA), 7/45 (15.6%) on internal expert opinion, and 2/45 (4.4%) on the American Thoracic Society. 25/45 (55.6%) policies and guidelines were consistent with ACIP recommendations. 17/38 (44.7%) outpatient clinic sites had required written policies or formal guidelines. 11/17 (64.7%) sites had policies/guidelines that were consistent with an affiliated hospital system. Of those with policies or guidelines developed independent of or modified from inpatient health systems, 5/8 (62.5%) were based on ACIP, 3/8 (37.5%) on IDSA, and 2/8 (25%) on internal expert opinion. 6/8 (75.0%) protocols were consistent with ACIP guidelines.

Conclusion: Many sites lacked written immunization policies or guidelines. In the inpatient setting, there was a large discrepancy between referencing ACIP for adult pneumococcal immunization policy and having guidelines consistent with ACIP recommendations. These observed differences in policy suggest that considerable practice variation may exist in vaccination procedures. The development of standardized approaches to implementing national recommendations into local health system guidelines could reduce the variability in institutional policies surrounding adult pneumococcal immunization programs. Pharmacists may serve a key role in more consistent interpretation and application of pneumococcal immunization recommendations across adult practice settings.

6-094

Category: Infectious Diseases

Title: Big data analysis of epidemiological patterns of carbapenem-resistant enterobacteriaceae

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Purpose: In 2013, the Centers for Disease Control and Prevention (CDC) declared Carbapenem-resistant Enterobacteriaceae (CRE) an urgent antibiotic-resistant threat. It is estimated that more than 9,000 healthcare-associated infections (HAIs) are caused by CRE each year. While nineteen states have taken the initiatives to require CRE reporting, there is currently no single national CRE surveillance system available to provide a true prevalence rate at any given point in time. Using a large cross-sectional dataset (big data), the purpose of this study was to examine epidemiological patterns of CRE.

Methods: An electronic surveillance clinical decision support database containing patient demographics, medication orders and clinical data from over 200 acute care hospitals was utilized to construct the study cohort comprised of patients with positive microbiologic cultures for CRE. CRE was defined as any Escherichia coli and/or any Klebsiella species with intermediate or resistant susceptibility to imipenem, meropenem, or doripenem. Patients with positive CRE cultures for the study period January 1, 2013 to December 31, 2014 were examined.

Results: There were 1412 CRE positive cultures identified. CRE organisms include Escherichia coli (303), Klebsiella pneumoniae (1083) and Klebsiella oxytoca (26). The most common causative CRE organism was K. pneumoniae which was identified in 1083 cultures (76.69 percent). Of all the positive CRE cultures, 1051 CRE organisms (74.43 percent) were identified less than 72 hours upon hospital admission. The average length of stay for patients with CRE organisms identified greater than or equal to 72 hours upon admission was significantly longer compared to patients with CRE identified less than 72 hours upon admission, 34.30 days and 6.02 days, respectively. The mean difference was 28.27 days (95 percent confidence interval, 25.35 to 31.19; P equals 0.0001). There were an increasing number of CRE positive cultures from the year of 2013 to 2014, 578 compared to 834 positive cultures, respectively.

Conclusion: This study analysis of CRE data revealed an alarmingly high number of CRE positive cultures identified within the first 72 hours of admission. This finding suggests that CRE screening of high-risk patients on admission may be indicated to ensure timely isolation, thereby reducing the risk of hospital-onset transmission. Our analysis shows that using large datasets

compiled from multiple healthcare facilities allow for recognition of epidemiological patterns that may identify patients at risk for HAIs and multidrug resistant organisms leading to early intervention. We strongly encourage healthcare provider organizations to look for opportunities to share data and advance healthcare.

6-095

Category: Infectious Diseases

Title: Assessing the overall consumption and cost of antibiotics In the Middle East and North Africa Region

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Purpose: The objective of the study was to evaluate the overall consumption and cost of antibiotics in the Middle East and North Africa Region (MENA).

Methods: Retail-based antibiotics consumption and cost data from 9 countries in the Middle East and North Africa region have been collected from 2012 through 2014. The countries are Algeria, Egypt, Jordan, Kuwait, Lebanon, Morocco, Saudi Arabia, Tunisia, and United Arab Emirates (UAE). Antibiotics have been classified into 14 major pharmacological categories. The cost has been standardized to Cost, Insurance, and Freight (CIF) in U.S.dollars ($) to minimize impact of country-specific drug pricing regulations. Antibiotic dosage form has been set to oral, parenteral or other routes. The data analysis consisted on data related to the oral and the parenteral routes only. The unit of the oral is box of tablets, caplets, capsules, granules, syrup bottle etc. Moreover, antibiotics intended for parenteral administration were reported in unit dose (one vial, or injection, etc). Since this study did not involve human participants or the review of participant records, this study did not require IRB review.

Results: Data analyzed were reported per country and per dosage form. Since the data is retail-based, data for antibiotics intended for oral route were further assessed to generate the followings: a) The ratio of antibiotic cost/unit box/country [Total antibiotics cost in 2014/Unit Box in 2014 per country] showed that Kuwait antibiotics were the most expensive with $13.9/Unit Box, followed by UAE ($12.0), Saudi Arabia ($9.4), Lebanon($7.3), Morocco ($6.7), Jordan ($6.1), Tunisia ($4.7), Algeria ($4.1), and Egypt ($2.0). b) The ratio of antibiotic consumption/population [Unit Box in 2014/country population] showed that Lebanon reported the highest consumption of antibiotics in the community with 1.46 unit box/resident, followed by 1 for Algeria, Egypt, and Saudi Arabia, UAE (0.8), Jordan (0.7), Tunisia (0.6), Kuwait (0.4), and Morocco (0.2).

Conclusion: These findings revealed a huge difference (up to $11.9) in the average CIF cost of antibiotics in different countries in the MENA region. Such difference will be amplified secondary to country-specific drug pricing regulations. Additionally, the data confirmed the overuse of antibiotics in Lebanon compared to countries in the MENA region. Such overuse in Lebanon and other countries as well may be due to overprescribing and sometimes to lack of law enforcement.

6-096

Category: Leadership

Title: Collaborating for safety: a pharmacy-driven multidisciplinary approach to medication safety

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Purpose: Within the patient safety realm, medication errors are known to be one of the most common causes of patient harm worldwide. The use of advanced technologies such as automated dispensing cabinets and anesthesia procedure carts in conjunction with pharmacy automation greatly reduces the risk of these errors from the human standpoint. Successfully building a safety approach to this end involves cooperation and collaboration across disciplines to achieve the highest levels of efficiency, satisfaction, and safety. A pharmacy driven initiative to involve key stakeholders in achieving these goals was the focus of this project to enhance patient safety.

Methods: The development of an expansive technology project involving pharmacy automation, automated dispensing cabinets for the patient care areas and automated anesthesia procedure carts in the procedure areas was initiated by pharmacy leadership with administrative approval of the project. Once the pharmacy components were in place, the additional component of the automated dispensing cabinets and anesthesia procedure carts was developed and implemented with the involvement of those end-user disciplines responsible to actually utilize the technology. A Core Team including the front line nurses, nursing education, the chief nurse anesthetist, the operating room nurse manager, and other procedure area nurse managers was established, led by the initial pharmacy core team and pharmacy leadership. Routine weekly and ad hoc meetings were held, on site training at the vendor's location was attended as a group, and joint collaboration to develop workflows and efficiencies were developed from the standpoint of all disciplines to assure all workflow and regulatory needs were met.

Results: A successful implementation resulted from the preplanning and collaboration done across disciplines. The multidisciplinary Core Team was able to standardize methods and processes for shared or common tasks as well as individualize discipline-specific functions in a manner that was consistent and clearly understood by the group in the scope of the entire project. The group developed the implementation and go-live plan with each subset of the Core Team responsible to develop training and workflows impacting their areas of practice, but worked together to keep processes consistent. Core Team subset leaders trained their respective areas, and assisted with cross-training others as needed. Pharmacy oversight as the project coordinators and the pharmacy director as project manager drove the project to a successful completion.

Conclusion: Pharmacy leadership of this important medication safety project helped guide a successful implementation and adoption of this advanced technology. By involving those specifically impacted by the processes, the end-users played a significant role in defining what workflows would be best suited for their areas from their unique perspectives. The end results of

enhanced patient safety and more efficient workflows were combined with increased satisfaction of all team members, staff members, and patients as well.

6-097

Category: Leadership

Title: How to become an effective management team

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Purpose: To improve the effectiveness of a management team in the hospital pharmacy. Management theory describes that working as an effective management team strengthens the success rate of effective changes. Working as an effective management team creates a coalition of effective managers that engage the academic employees in this case pharmacists in a joint coordination, commitment and direction. Furthermore the aim is to improve employee recruitment, development and maintenance/retention. This creates a basis for knowledge sharing and effective working operation that heighten the framework of better patient treatment.

Methods: The management team consists of an area manager and three 1.line managers. To acquire joint competencies as an effective management team the team worked with joint coordination, commitment and direction. Emphasis has been on commitment divided into; 1: Success and personal benefits for all, 2: Direct and investigative dialogue about the most important topics, and 3: Strong personal relations. To develop these qualities further the management team took part in a leadership seminar. To create success and personal benefits for all, each manager was coached on their individual management challenges. In order to achieve a direct and investigative dialogue about the most important topics the management team participated in a group development interview mediated by an external consultant. The question posed for this interview was: What would be beneficial for the management team to do in order to get the management team expectations to the pharmacists fulfilled? To create strong personal relations the managers identified and presented their personal values. These values were merged into a set of management values that every manager could agree on. The process and values was presented and implemented to all relevant parties within the pharmacy.

Results: All four managers participated in the work leading to become an effective management team. The emphasis on commitment revealed similar management challenges across management levels and size of staff group. The coaching session resulted in more open communication between the managers and thereby increasing the trust to one another within the management team. At the group interview a list of relevant concrete management tasks was identified and prioritized. The management team defined at set of values: Hope, Cooperation, Openness, and Engagement. The work on defining a set of values creates strong interpersonal relations in the management team. The process and the set of values were presented to and positively met by employees, colleagues as well as top management. The values are

implemented in the current staff group and are used when recruiting new employees. An evaluation of the success of propagation to the staff of focus on commitment showed that the 18 number of employees has been through an exchange program, 21 projects has been completed. Sick leave has maintained 3 % during the development period, which is beyond the maximal goal for the organization at 4.5 %.

Conclusion: Focus on commitment developed strong interpersonal relations within the management team. A result of this was a more effective management team across management levels. A set of values was defined and implemented.

6-098

Category: Leadership

Title: Using the lean management system (LMS) to achieve targeted outcomes

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Purpose: The pharmacy leadership team (PLT) was becoming frustrated, because it seemed like we were fixing the same problems over-and-over. The health system recently hired a process improvement (PI) specialist who was interested in developing a pilot hall for incorporating the lean management system. The pharmacy volunteered to be the pilot hall. This case describes the journey through the education of the PLT, development of our balanced score card (BSC) and resulting positive outcomes.

Methods: During its annual strategic planning process, the PLT identified problem areas we thought had been addressed, but were still an issue. These included: venous thromboembolism (VTE) assessments by pharmacists within 24 hours of admission, medication histories taken by a pharmacist within 24 hours of admission and carousel turnaround time. The PLT, along with the help of an in-house expert on lean methodologies, incorporated standard lean tools such as problem solving sheets, an innovation system and, the compass of the system, the balanced score card (BSC), in to our process improvement work. The PLT developed a BSC, with goals cascaded from the organizations goals, for fiscal year 2015. A central board, in the department, was used to display the BSC, so all staff could be involved. Four pillars were used to create our BSC: people, quality, service and finance. Problem solving sheets were used to identify opportunities as well as to help prioritize the top three problems, related to each pillar within the BSC. A support row was included to show daily measurement of each of the opportunities. In addition, an innovation system was developed which allowed all staff the ability to participate in moving the department towards its targets.

Results: We are actively measuring twelve objectives three under each of our four pillars. As of May 2015, six (50%) of the objectives have been achieved. Five (42%) of the objectives are trending towards the goal, and it is anticipated that the goal will be reached by the end of the measurement period (September 2015). One (8%) of the objectives is not trending towards the goal. Between 10/1/14 and 5/31/15, 21 employee innovations have been implemented. There were also striking improvements in some of our objectives. Examples are: Quality Objective 2: 90% of inpatients will have their VTE prophylaxis status reviewed by a pharmacist, within 24 hours of admission (Oct 2014: 49%, May 2015: 90%); Quality Objective 3: < 5% of inpatients, on vancomycin, with stable renal function, will have an increase in SCr > 0.3 mg/dL (Feb 2015: 8.4%, May 2015: 4.4%); Service Objective 1: 90% of pain medication orders, submitted through CPOE, will be verified within 10 minutes (Oct 2014: 65 %, May 2015: 72%); Service Objective 3: Carousel turnaround time (time from when message hits Carousel to when med

Conclusion: Utilization of a lean management system provides the framework and tools for pharmacy leaders to be able to set and achieve objective goals. By involving all members of the

pharmacy team, goals are understood by all and the whole team feels responsible for achieving them. An innovation system is a powerful tool to engage employees and demonstrate how their contributions help achieve departmental goals. By aligning leadership and front-line staff, along with the support of the lean management system, an environment is created where process improvement is viewed as an essential part of daily work.

6-099

Category: Leadership

Title: Learning beyond the book: guest lectures hosted by pharmacy student organizations serve educational value

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Purpose: There is an increasing need to expose pharmacy students to common contemporary U.S. practice models.(https://www.acpe-accredit.org/pdf/Standards2016FINAL.pdf) Although students undergo practical education, including introductory pharmacy practice experiences (IPPEs), currently there's variability among institutions regarding availability of IPPE practice sites. Potentially, this could lead to a lack of access to numerous pharmacy career opportunities. Thus, student organizations may play an important role to fill this gap and provide students with exposure to these opportunities. The purpose of this study was to measure the impact and efficacy of lectures held by guest speakers at student organization meetings in disseminating information about post-graduate career opportunities.

Methods: First- to third-year Doctor of Pharmacy students from the University of Illinois at Chicago, College of Pharmacy, were invited to attend a guest lecture series hosted by the Asian Pharmacists Association. A goal of this professional student organization is to provide community service opportunities and professional education for its members. Voluntary guest lectures took place during general body meetings with a focus on post-graduate training and pharmacy career opportunities. Information presented and discussed during the first lecture included pharmacy residencies, fellowships, and specialty pharmacy services. The second lecture included information about the pharmaceutical industry, medical affairs, and pharmacy management experiences. To assess impact, 2 surveys were administered at each lecture - 1 before and another following the lecture. Both surveys contained identical questions. This was performed to measure the impact on the students' body of knowledge regarding the presented content. Survey questions were designed with responses on a Likert Scale of 1 to 5 with 5 representing "highest amount of understanding." The responses were collected and documented using Microsoft Excel. The inferential portion of the statistical analysis was conducted using a 1-tailed paired t-test.

Results: In total, 21 and 26 pharmacy students attended the 2 lectures, including first-year (42.9 percent, n=9; 30.8 percent, n=8), second-year (42.9 percent, n=9; 50.0 percent, n=13), and third-year (14.3 percent, n=3; 11.5 percent, n=3) students, respectively. The second lecture had 2 unidentified participants. Pre-surveys showed students generally understood the purposes of residencies and fellowships (average mean=3.85 and 3.41 of 5 on the Likert scale, respectively).

Additionally, the pre-survey showed that students lacked understanding about the nature of specialty pharmacy services and the purpose of medical affairs (average means=2.46 and 2.81, respectively). However, post-surveys demonstrated improved understanding of these topics (average means=4.52 and 4.12, respectively). Overall, the average mean score of both lectures had statistically significant improvement from pre- to post-surveys (from 3.13 to 4.17 for the first lecture, p=0.002; from 3.13 to 4.12 for the second lecture, p=0.0004). First-year students demonstrated the greatest improvement in scores from average means of 2.88 to 4.04 (40.3 percent increase) and from 2.70 to 4.03 (49.3 percent increase) for the first and second lecture, respectively. In contrast, third-year students demonstrated the smallest improvement in scores from average means of 3.83 to 4.11 (7.3 percent increase) and from 3.85 to 4.87 (26.5 percent increase), respectively.

Conclusion: In conclusion, the data suggested that pharmacy students gained knowledge of post-graduation career opportunities after attending guest lectures hosted by a student organization during general body meetings. Compared to third-year students, first-year pharmacy students learned the most. Extracurricular activities, such as professional organization participation, are an effective method to illustrate and educate pharmacy students about post-graduation career opportunities, especially when exposure during the scheduled curricula may be lacking or inconsistent among different institutions. These lectures may also help students understand early on in pharmacy school what experiences and skill sets are need to enter certain pharmacy careers.

6-100

Category: Oncology

Title: Evaluation of antimicrobial therapy utilization in patients with febrile neutropenia at a community teaching hospital: a retrospective study

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Purpose: Febrile neutropenia (FN) is a life-threatening complication of chemotherapy that occurs at least once in 50-80% of cancer patients. The Infectious Diseases Society of America (IDSA) has developed guidelines for antimicrobial therapy management in patients with FN which were most recently updated in 2010. The purpose of this retrospective study is to determine adherence to the IDSA guidelines for the use of antimicrobial agents in FN to identify specific gaps in care.

Methods: This retrospective chart review was approved by the hospitals Institutional Review Board. Patients were included in the study if their primary admission diagnosis was febrile neutropenia. Patients were reviewed to ensure they met criteria for febrile neutropenia (an oral temperature of greater than or equal to 38.3 degrees C (101 degrees F) or greater than or equal to 38.0 degrees C (100.4 degrees F) sustained over 1 hour, and an absolute neutrophil count (ANC) of less than or equal to 500 cells/cubic millimeter during their hospital stay. Patients were excluded from the study if they also had human immunodeficiency virus or sickle cell disease. Baseline demographic data was collected, as well as data specific to antibiotic use: time to first dose of antipseudomonal antibiotic, other antibiotic, antifungal or antiviral therapy, escalation and de-escalation strategies, time to recovery of ANC, length of stay, 30-day readmission rate and mortality. Granulocyte-colony stimulating factor (GCSF) use was also evaluated in terms of appropriateness and impact on patient outcomes.

Results: Seventy seven patients were included in the analysis. The average age was 60 years and breast cancer was the most common cancer diagnosis (16.9 percent of patients). More than half of patients (54.5 percent) were admitted with an ANC less than 100 cells/cubic millimeter. Median time to administration of antipseudomonal antibiotic was 2 hours with cefepime and piperacillin-tazobactam being used most commonly (43 percent and 40 percent, respectively). All patients had antibiotics started within 2 hours regardless of whether admitted through the ER, direct admission or admission through the cancer center. Inappropriate antibiotic use was identified in 25 percent of patient and, interestingly, the majority of these situations called for broadened antibiotic coverage or longer duration. Thirty three percent of patients received GCSF for treatment of FN. The average time to recovery of the ANC and afebrile was 4.5 days and this time was unaffected by antibiotic choice or use of GCSF ($p=0.056$ and $p=0.1$, respectively). The

average length of stay was 13.7 days and also was not affected by antibiotic choice or use of GCSF ($p=0.223$ and $p=0.255$, respectively). Thirty day readmission rate and mortality were likewise unaffected by antibiotic choice and use of GCSF.

Conclusion: Time to initial antipseudomonal antibiotic and overall antibiotic choice was consistent with IDSA guidelines. Choice of antipseudomonal antibiotic did not affect any of the outcomes studied. Several opportunities to improve antibiotic utilization were identified. Also, given GCSF is not recommended for treatment of FN, an opportunity exists for optimization of GCSF utilization. This is especially true given the lack of effect of GCSF on time to recovery, length of stay, readmission rate and mortality. The development of an order set that includes IDSA recommendations would help ensure evidence-based care.

6-101

Category: Oncology

Title: Incidence and Risk Factors of Rituximab-induced Interstitial Lung disease in the non-Hodgkin lymphoma Patients

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Purpose: Rituximab, which is a chimeric anti-CD20 monoclonal antibody, is a widely used standard treatment for non-Hodgkin lymphoma (NHL). Serious pulmonary adverse reactions have been highlighted since widespread use in treatment. This kind of disease is rare but requires medical intervention and influences both mortality and morbidity. The aim of this study was to determine the incidence and the clinical features of rituximab-induced interstitial lung disease (RILD) and to investigate the risk factors associated with RILD development.

Methods: The eligible patients, total number of 159, were the ones who received rituximab-containing chemotherapy at least once, as first-line regimen from August 2009 to September 2012 at Asan Medical Center. Among them, those who had radiographic findings and related symptoms but had no other evidence of infection were classified as RILD patients. Retrospective data collection was conducted by using Electro Medical Record and statistical analysis was performed with SPSS version 23.0.

Results: Among 159 patients, 13 of them (8.2 %) were classified as RILD patients. The major symptoms were fever and cough (61.5 %) and 5 patients (38.5 %) suffered from severe symptoms like dyspnea. 4 patients (30.8 %) were immediately dropped out from the whole chemotherapy, one of them expired. The symptoms did not recur for the remaining 9 patients (69.2 %) who further continued on the regimen without rituximab. According to radiographic findings, 9 patients showed full recovery after 1 year from the onset day, whereas 3 patients showed partial recovery. 1 patient lost follow-up. The predictive risk factors were the history of tuberculosis (odds ratio (OR): 5.84, 95 % confidence interval (CI): 1.17-29.23, $p<0.05$) and the febrile neutropenia between chemotherapy (OR: 6.89, 95 % CI: 1.69-28.15, $p<0.01$).

Conclusion: RILD incidence is higher than manufacturers previous report (<0.03%). Clinicians should have high alert on NHL patients receiving rituximab-containing regimen and early detection should be made when patients have any symptom of pneumonitis. But in this study, differential diagnosis was uncertain due to lack of diagnostic procedure such as bronchoalveolar lavage (BAL) to rule out infectious disease. Further study of risk factors and mechanisms of RILD is required.

6-102

Category: Oncology

Title: Evaluation of left ventricular ejection fraction (LVEF) monitoring in patients receiving trastuzumab therapy in an outpatient cancer center

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Purpose: Trastuzumab is a monoclonal antibody used to treat breast cancer in patients with overexpression of human epidermal growth factor type 2 (HER2). Trastuzumab has been shown to cause a reversible decline in LVEF, and consequently the product label recommends specific interval LVEF monitoring. The purpose of this study was to evaluate LVEF monitoring adherence in patients receiving trastuzumab at an outpatient cancer center.

Methods: A retrospective analysis was performed to determine if patients receiving at least one dose of trastuzumab for treatment of HER2+ breast cancer between 2010 and 2014 were monitored for reduced LVEF at the recommended intervals: baseline, 3 months, 6 months, 9 months, 12 months, and 6 months post therapy. Results of either ECHO or MUGA scans reported in the patients' electronic medical record were recorded. The expected dates for LVEF monitoring were determined based on the patients first administered trastuzumab dose. The LVEF had to be measured within one month of the expected test date to be considered adequate monitoring. Dates within one month pre or post the expected date were chosen to account for variance in monitoring due to scheduling. Monitoring that fell outside of the defined acceptable interval was also recorded.

Results: Between 2010 and 2014, 40 patients received trastuzumab at least once, and every patient received a baseline LVEF measurement. Of the 35 patients qualifying for a three month measurement, 31 patients were tested appropriately (88.57%), three were tested outside of one month from the expected test date, and one additional patient was not tested. At six months, 27/33 patients (81.82%) were tested appropriately, another four were tested outside the grace period and two were not tested. At nine months, 21/31 patients (67.74%), had an LVEF measurement at the correct time while four patients were measured outside the test window. Additionally, 17/32 patients (53.13%) had an appropriate LVEF measurement at 12 months with six measured outside the testing window. Twenty-eight percent of patients had a six month post-therapy LVEF measured appropriately. Additionally, three patients continued trastuzumab longer than 12 months, and some of these cases are ongoing. A combined ten additional follow-ups were mapped out at three month intervals, and these patients were tested appropriately 40% of the time.

Conclusion: Based on the results, there is a clear trend showing fewer patients are tested for signs of drug induced heart failure as time progresses from therapy initiation. Currently, all

patients' baseline LVEF is monitored before trastuzumab initiation. However, only 28% of patients were monitored six months post-therapy. Our future goal is to incorporate LVEF monitoring reminders into trastuzumab order sets to improve adherence to recommended monitoring guidelines.

6-103

Category: Oncology

Title: Comparison of a single dose palonosetron-containing regimen versus an around the clock ondansentron-containing alternative for chemotherapy-induced nausea and vomiting

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Purpose: Chemotherapy-induced nausea and vomiting (CINV) is a common and difficult-to-manage toxicity in patients undergoing chemotherapy. Although a variety of antiemetic regimens are available to prevent CINV, finding the optimal balance between efficacy and cost remains challenging. The purpose of this study was to compare the effectiveness of a palonosetron-containing antiemetic protocol to an around-the-clock, ondansetron-containing alternative regimen in patients receiving moderately (MEC) and highly (HEC) emetogenic chemotherapy.

Methods: The institutional review board approved this single-center, bi-phasic study consisting of a retrospective chart review and a prospective pilot phase of patients 18 years or greater who received a MEC or HEC regimen. Patients were excluded for the following reasons: prior history of anticipatory nausea or vomiting, use of antiemetics 24 hours before chemotherapy, receiving a high dose ifosfamide-containing regimen, and those receiving outpatient chemotherapy. During phase I, a retrospective chart review was conducted of patients who received the institutional protocol consisting of palonosetron-dexamethasone dual therapy for MEC, and palonosetron-fosaprepitant-dexamethasone triple therapy for HEC. During phase II, patients were prospectively switched to an ondansetron-containing alternative regimen. Patients undergoing MEC and HEC received ondansetron-fosaprepitant-dexamethasone triple therapy followed by additional coverage with ondansetron twice daily during days 2 through 4. The primary outcomes were the proportion of patients achieving complete response and the average number of rescue doses required per patient during the acute, delayed, and overall phase. The secondary outcome included the cost-savings associated with a palonosetron-sparing antiemetic protocol. Statistical analysis was performed using Fishers exact test for categorical data and unpaired Students t-test for continuous variables.

Results: Thirty four patients, 17 in each arm were included in the study. Baseline characteristics were similar between groups. Complete response during the acute phase was 82 percent in both groups (95 percent CI, 58 percent to 95 percent; P equals 1.00), 59 percent (95 percent CI, 36 percent to 78 percent) versus 71 percent in the delayed phase (95 percent CI, 47 percent to 87 percent; P equals 0.72), and 53 percent (95 percent CI, 31 percent to 74 percent) versus 64 percent during the overall phase(95 percent CI, 41 percent to 83 percent; P equals 0.73) in the palonosetron and ondansetron group, respectively. Additionally, the average number of rescue

doses required per patient was not statistically significant between groups across all three phases. The estimated annual cost savings associated with a palonosetron- sparing institutional protocol was $ 29,300.

Conclusion: An around-the-clock, ondansetron-containing regimen appeared to be as effective as the current palonosetron-containing institutional protocol in preventing chemotherapy-induced nausea and vomiting while providing additional cost-savings benefits.

6-104

Category: Oncology

Title: Provision of High Cost Hematology/Oncology Medications in the Outpatient Setting

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Purpose: The administration of biotherapy and chemotherapy in the outpatient setting was identified as an unrealized opportunity at Ascension Health. During the period from July 1, 2013 to April 30, 2015 more than 20 million dollars were spent on high cost hematology/oncology medications, including rituximab, bevacizumab, and trastuzumab in the inpatient setting. An opportunity existed to deliver this same quality care in the outpatient setting by trained oncology practitioners with the added benefit of being reimbursed for medication administration.

Methods: An expert group of multidisciplinary hematology/oncology clinicians reviewed the opportunity to shift high cost medications from the inpatient to the outpatient setting. It was determined that therapy must be of urgent or emergent need to be administered in the inpatient setting. In addition, key criteria were developed to provide guidance on requirements for inpatient therapy, including the following: patient with a high risk for tumor lysis syndrome, patient with a history of NCI CTCAE Grade 3 or 4 hypersensitivity, continuous infusion therapy administered with short stability, central line access required during infusion therapy with a vesicant, or outcome dependent on relative dose intensity, but patient is unable to be discharged. The work of the expert group included development of an SBAR document and executive summary slides. This clinical initiative was formally approved through the Ascension Healths Oncology Affinity Group, Therapeutic Affinity Clinical Subcommittee, and the Therapeutic Affinity Group. It was then communicated to all health-system clinical leaders for comment over a 14 day period. Once all comments were received and concerns addressed, approval by the Clinical Executive Committee and Ascension CMO was obtained. Health-system sites were then given 90 days to implement the initiative.

Results: The number of units of rituximab, bevacizumab, and trastuzumab purchased in the inpatient setting were monitored on a dashboard viewed by all of the health-systems. The percentage of units procured in the outpatient setting increased from 26% to 65% for trastuzumab, 18% to 60% for rituximab, and 16% to 70% for bevacizumab from July 2013 to April 2015. Other high cost medications including PEMEtrexed, bortezomib, bendamustine, cyclophosphamide, PACLitaxel, leuprolide, and cetuximab also experienced increased procurement in the outpatient setting during the same time period.

Conclusion: Collaboration of an expert clinician group along with an established review and implementation process resulted in the shift in high cost hematology/oncology medications

including rituximab, bevazicumab, and trastuzumab to the outpatient setting in a large health-system. This resulted in providing evidence-based care to the hematology/oncology patient population that is safe, efficient, and delivers patient value.

6-105

Category: Oncology

Title: Bcl-2 family inhibition sensitizes PC3 prostate cancer cells to docetaxel

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Purpose: Docetaxel (DTX) is a useful chemotherapeutic drug for the treatment of hormone-refractory prostate cancer. However, emergence of DTX resistance has been a therapeutic hurdle. Alternatively, Bcl-2 family molecules play a crucial role in mitochondria-mediated apoptosis. The family of Bcl-2-related anti-apoptotic proteins includes Bcl-2, Bcl-xL, Bcl-w, and Mcl-1. Inhibition of Bcl-2 and/or Bcl-xL is hypothesized to potentiate the effect of chemotherapy, and several Bcl-2 family inhibitors/antagonists have been developed. In this study, we investigated the effect of combining DTX with Bcl-2 family inhibitors on human prostate cancer cell lines.

Methods: Three human prostate cancer cell lines (PC3, LNCaP, and DU145) were used. DR-PC3 is a DTX-resistant PC3 cell line. Three Bcl-2 family inhibitors (ABT-263, ABT-199, and ABT-737) were used. ABT-263 (Navitoclax) is an orally bioavailable inhibitor of Bcl-2, Bcl-xL, and Bcl-w, with the same specificity as ABT-737 that can be administered systemically. ABT-199 is an orally bioavailable inhibitor of Bcl-2 and Bcl-w, but not Bcl-xL. To knockdown Bcl-2 family molecules, specific siRNAs were transfected. Cell death was assessed using the Annexin V-FITC Apoptosis Detection kit and propidium iodide. Immunoblot was performed using the primary antibodies against several caspases and Bcl-2 family proteins, and goat anti-rabbit or goat anti-mouse alkaline phosphatase-conjugated secondary antibodies were used to detect the primary antibodies. In a xenograft mouse model, male BALB nu/nu mice were subcutaneously inoculated in the right flank with PC3 cells and Matrigel. Thereafter, these PC3-bearing mice were treated with DTX and/or ABT-737. All experiments with animals in this study were approved by the Ethics Committee for Animal Experimentation of Shimane University and they were handled according to our institutional guidelines. Data were evaluated statistically using an unpaired two-tailed Studentf's t-test or an ANOVA together with Bartlettf's test.

Results: Among three cell lines, PC3 cells were relatively resistant to DTX. DU145 cells were less sensitive to Bcl-2 family inhibitors, ABT-263 and ABT-199, compared with the other two cell lines. ABT-263 decreased the viability of PC3 cells more drastically than did ABT-199 with suboptimal doses of DTX. Such a synergistic effect was not observed in LNCaP or DU145 cells. Flow cytometry and immunoblot analysis revealed that co-treatment with ABT-263 and DTX induced apoptosis in PC3 cells in a caspase-9-dependent manner. Immunoblot analysis revealed that three prostate cancer cell lines expressed Bcl-2 and Bcl-xL proteins at the comparable levels.

In RNA interfering experiments, the augmented antitumor effect induced by ABT-263 in PC3 cells treated with low-dose DTX was primarily due to inhibition of Bcl-xL. ABT-263 sensitized DR-PC3 cells to DTX-induced cytotoxicity. In a xenograft mouse model, intraperitoneal administration of ABT-737 sensitized PC3 cells to DTX significantly.

Conclusion: Our data indicate that Bcl-2 family inhibitors, ABT-263 and ABT-737, effectively enhance DTX-induced antitumor effects on DTX less sensitive human prostate cancer cells both in vitro and in vivo. The effect seems to be exerted via an inhibition of Bcl-xL. These findings suggest that these Bcl-2 family inhibitors may be promising agents for restoring DTX sensitivity to DTX-resistant human prostate cancers.

6-106

Category: Pain Management

Title: EMA NSAID recommendations: 12 months post-implementation follow up audit

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Purpose: In 2013 the European Medicine Agency (EMA) demonstrated that the cardiovascular effects of systemic diclofenac are similar to those of COX-II inhibitors1. As a result the Mater Misericordiae University Hospital (MMUH) removed oral diclofenac from the formulary and added dexketoprofen as a parenteral option. Ibuprofen was chosen as the oral NSAID of choice.

Methods: A web-based prescribing guideline was implemented to assist in the selection of an appropriate NSAID. An NSAID prescribing audit was conducted prior to formulary amendment and guideline implementation. Post-implementation audits were conducted at six weeks and 3 months. Strategies to increase compliance involved re-communication of the guidelines. Clinical pharmacists conducted a one-day, cross-sectional re-audit of systemic NSAID prescriptions in MMUH in-patients. Analysis of the results was compared with previous audits

Results: Oral ibuprofen is the most commonly prescribed NSAID (75% of NSAID prescriptions). One prescription for oral diclofenac, a decrease from 11 oral diclofenac prescriptions pre-implementation and 16 (six weeks) and 5 (3 months) oral diclofenac prescriptions post change-over. Prescribing of non-formulary NSAIDs decreased to 2.5%. Non-formulary NSAIDs consistently accounted for 10% of NSAID prescriptions in the previous three audits.

Conclusion: The successful implementation of the web-based NSAID prescribing guideline and EMA recommendations combined with increased clinical pharmacists interventions has resulted in decreased use of oral diclofenac and improved formulary compliance. Ibuprofen remains the principal oral NSAID prescribed one year post intervention, thereby conforming to EMA recommendations and, by restricting Diclofenac use, minimising the associated risk of arterial thromboembolic events.

6-107

Category: Pain Management

Title: Outcomes of a pharmacist-managed perioperative analgesia pilot program

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Purpose: Acute pain in hospitalized patients is often sub-optimally managed. Postoperative pain is one of the most common forms of acute pain and represents an area where new analgesic strategies can be employed. Traditionally, as-needed analgesics are not administered until patients are already in pain and request relief. Pharmacist knowledge and expertise of medication management can be used proactively to manage the analgesic needs of surgery patients perioperatively. Employing analgesic strategies prior to the onset of pain may decrease overall pain medication requirements and ultimately improve both pharmacotherapeutic and pharmacoeconomic outcomes.

Methods: A small pilot group of surgeons, anesthesiologists, and pharmacists was established to develop a perioperative analgesia pilot. An extensive literature review was performed in order to identify medications that had data supporting their use for perioperative analgesia. A standardized flow-sheet was then created to be used by clinical pharmacists to provide consistent results. Patients of specific physicians were randomized prospectively to either a control group or an intervention group. The intervention group was managed preoperatively by a pharmacist who was trained to use the flow-sheet and appropriately assess the need for preoperative analgesia. A comprehensive assessment was completed at bedside for each patient in the intervention group. The control group received no preoperative pharmacist intervention and was treated according to the standard of practice. Postoperatively, upon arrival to the postoperative care unit (PACU), patients pain was assessed on a visual analogue scale (VAS) and again at 15, 30, 45, and 60 minutes. Cumulative morphine equivalents (ME), medication cost, and PACU length of stay were compared between cohorts.

Results: A perioperative collaborative practice agreement pilot was successfully implemented in the surgical units of our facility. A total of 58 patients were evaluated. Twenty nine patients were enrolled in the intervention group and 29 were treated according to the current standard of care. Reduced average pain scores in the intervention group were observed when compared to the standard of care. The intervention cohort had an average pain score of 0.9 compared to 1.5 in the standard of care cohort ($P< 0.02$). The intervention group used an average of 1.5 morphine equivalents while in the PACU as compared to 8.2 which represents an 82% reduction in morphine equivalents administered in the intervention group ($P< 0.01$). Average PACU length of stay in the intervention group was 60.9 minutes as compared to 68.4 minutes in the standard of

care group. This difference represents an average of $100.21 reduction per patient visit in the intervention group. Based on an average daily patient load of 80-120 patients, this represents a potential cost savings of $8,016 to $12,025 per day and potential annual cost savings estimate of $2,004,200 to $3,006,300 assuming all patients were to receive the intervention.

Conclusion: A pharmacist-driven, preoperative, multimodal approach to postoperative analgesia can be achieved through a combination of therapies that continue beyond the immediate perioperative time frame. This multimodal approach provides superior analgesia with opioid-sparing effects, as well as an opportunity to lower cost to patients. This protocol serves as a model for innovative strategies to improve pain scores, reduce opioid use, health care costs and PACU length of stays. Future directions include systematic implementation of this preoperative analgesia protocol, as well as postoperative pharmacy driven analgesia processes that may provide further opioid sparing modalities and cost savings throughout the system.

6-108

Category: Pain Management

Title: Patient perception of acute pain management: data from three tertiary care hospitals

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Purpose: As enforced by the American Academy of Pain Medicine and the American Pain Society, healthcare institutions have the responsibility to ensure the patients' right to optimal pain management. In addition to adequate pain relief, patients' overall satisfaction is shown to depend on multiple factors including engaging patients in their own care, encouraging their communication of pain, establishing a trust-based relationship, and delivering a quick intervention. The aim of this study is to assess patients' perception of their acute pain management during hospitalization, and their overall satisfaction with the treatment, in comparison to that of their health care providers.

Methods: Data collection was performed in three tertiary care hospitals, targeting two different patient populations who are most likely to experience acute pain: orthopedic surgery and obstetrics post-delivery patients. Between October 2014 and March 2015, patients admitted to these two units in the three hospitals were surveyed to assess their perception and feedback about the pain management they received and their overall satisfaction with the management. A secondary outcome included evaluation of agreement between the health care professional and patient-declared pain and treatment satisfaction. The Institutional Review Board approved this prospective cross-sectional study. A written informed consent was not needed. Participants were orally informed of the purpose of the survey and that their input was voluntarily and will remain anonymous.

Results: A total of 119 female patients in maternity units and 179 adult patients in orthopedic surgery units were surveyed on the first day following their procedure. In maternity and orthopedic patients respectively, unfavorable management practices included pain not being assessed prior to pain medication administration (19.3% and 30.5%), not being informed about importance of seeking pain treatment (16% and 18%), not being informed when they were administered pain medications (8.4% and 19.2%), having to wait for more than 30 minutes before getting the pain medication when requested (14.2% and 11.3%), not being provided with appropriate atmosphere to sleep at night (5% and 12.5%), and pain score not being documented on medical chart (95% and 93.2%). In general, 5.8% of the maternity and 10.7% of orthopedic patients were dissatisfied with the overall pain management they received. Healthcare input was obtained in 37% of maternity and 47.5% of orthopedic patients. In the maternity population,

there was a moderate absolute agreement between the health care professional and the overall patient-declared pain, with an ICC correlation coefficient of 0.594 [0.253; 0.778] (p=0.002). In the orthopedic population, no absolute agreement was found, with an ICC correlation coefficient of 0.273 [-0.124; 0.531] (p=0.077).

Conclusion: Patients presenting with acute pain expect and deserve utmost treatment. High-quality pain management includes appropriate assessment; collaborative care planning comprising patient involvement; and efficacious treatment resulting in overall patient satisfaction. Results will be shared with the concerned institutions to better understand their patient population needs, and improve on pain assessment and management.

6-110

Category: Pain Management

Title: Opioid-related adverse events following intravenous dosing with CR845, a novel peripherally acting kappa opioid receptor agonist with analgesic properties

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Purpose: CR845 is a peripherally restricted, highly selective kappa opioid receptor agonist (KORA) that is being developed for the treatment of pain. The peptidic structure of CR845 restricts its entry into the central nervous system (CNS) and differentiates it from other KORAs. Furthermore, because CR845 does not interact with mu opioid receptors and does not readily enter the CNS, it has not demonstrated the adverse event profile associated with clinically used mu opioids (eg, morphine), including human abuse potential, in clinical trials. Here, we present a pooled analysis of common opioid-associated adverse events observed in 3 clinical studies of CR845.

Methods: Intravenous (IV) CR845 was investigated in 3 double-blind, randomized, placebo-controlled, Phase 2 clinical studies for its ability to reduce post-operative pain upon bunionectomy or laparoscopic-assisted hysterectomy. The protocol for each study was reviewed and approved by the local investigational review board, and all subjects provided informed written consent prior to participation. Single or multiple IV doses of placebo or CR845 (ranging from 5 to 40 micrograms/kg) were administered pre- and/or post-operatively. Unblinded, pooled treatment-emergent adverse events (TEAEs) observed in the 24-hour period following administration of the first dose of study drug were analyzed by treatment group. The combined incidence of nausea or vomiting was analyzed with a generalized linear model to assess the distribution between treatment groups.

Results: 368 patients (mostly Caucasian females, average age 40-55 years) enrolled in these studies (placebo, n equals 152; CR845, n equals 216) and received at least 1 dose of study drug (intent-to-treat population). The majority of patients were enrolled in the laparoscopic hysterectomy studies (n equals 317, 86 percent). Post-operative nausea or vomiting was reported by 86 patients in the placebo group (57 percent; 95 percent CI 48 percent to 65 percent) and by 77 patients in the CR845 group (36 percent; 95 percent CI 29 percent to 42 percent; P equals 0.0001). The pooled percent incidence of nausea (34 percent vs 55 percent) and vomiting (3.7 percent vs 12 percent) was lower in the CR845 group than in the placebo group. In the 2 hysterectomy studies, rescue medication (mu opioid agonist) use was less in the CR845-treated patients than in placebo-treated patients, suggesting that the lower incidence of nausea and vomiting may have been associated with less use of opioid rescue medication. However, in the

post-bunionectomy study, fentanyl use was similar in the 2 treatment groups, suggesting that the decreased incidence in nausea and vomiting observed in that study was not solely related to a decrease in mu opioid rescue.

Conclusion: CR845 provided significant analgesia in these 3 clinical studies, and the results of this pooled safety analysis suggest that the lower incidence of nausea and vomiting in CR845-treated patients may not be fully explained by differences in mu opioid rescue medication use.
Disclosure: The 3 studies included in this pooled analysis were sponsored by Cara Therapeutics.

6-111

Category: Pain Management

Title: Knowledge of appropriate acetaminophen use and potential toxicity: a survey of female college students

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Purpose: Acetaminophen is the most commonly used medication in 18- to 44-year old women and also the leading cause of acute liver failure in the U.S. Overdose is often unintentional, due to misuse or simultaneous ingestion of multiple acetaminophen-containing products. Previous studies documented poor knowledge of recommended doses and toxicities; however, studies of younger women predate FDA-mandated labeling changes and are limited, despite high analgesic use in this population. The purpose of this study was to evaluate knowledge of appropriate acetaminophen doses and potential toxicities, recognition of products containing acetaminophen, and interpretation of Tylenol Drug Facts labeling in female college students.

Methods: Female college students 18 years and older were recruited for this cross-sectional, prospective study at a campus event. Participants were provided with a written survey consisting of 20 multiple-choice and open-ended questions. Information collected included demographics (age, education, race/ethnicity); ethanol intake; use of acetaminophen; knowledge of potential toxicities and maximum daily doses of acetaminophen; and ability to interpret Tylenol Drug Facts label information. After completing the survey, participants were offered informational leaflets as an educational intervention. All procedures were conducted in accordance with HIPAA regulations. Institutional Review Board exemption was obtained. Descriptive statistics were calculated for each variable.

Results: A total of 203 females (mean age, 19 years) participated in the study, of whom 82% identified themselves as white and 10% as Asian/Pacific Islander. Over 70% reported drinking alcohol at least once weekly. Pain was experienced on a daily or weekly basis by 22%, and 73% of subjects used acetaminophen, with 10% taking the medication at least twice weekly. Although more than half the subjects (57%) recognized that Tylenol contained acetaminophen, less than 15% knew Excedrin, Percocet and Tylox contained the analgesic. The maximum daily dose of extra-strength acetaminophen was correctly selected from six options by 64% of participants, and, when provided with the Tylenol Drug Facts label, 67% correctly identified the maximum amount of regular-strength acetaminophen recommended for a healthy adult. Subjects reported that they sometimes (57%) or always (29%) read label directions before taking acetaminophen-

containing medications. Liver problems were associated with high acetaminophen doses by 68% of participants, significantly more than those who selected distractor responses to this survey question ($p<0.001$). Further, 17 of 20 subjects who took acetaminophen at least twice weekly identified the potential for liver toxicity. Six of the 20 reported consuming 3 to 9 or more alcoholic drinks per week.

Conclusion: Overall, 73% of this younger female population took acetaminophen regularly, yet nearly one-third did not recognize liver toxicity as a concern with taking high doses. In addition, recognition of the content of brand name products was poor, potentially increasing the risk of toxicity due to unintentional simultaneous ingestion of multiple acetaminophen-containing products. Approximately one-third of the women surveyed were unable to interpret the Tylenol Drug Facts label and indicate the maximum recommended daily dose. These data suggest the need for educational efforts targeted to younger women, known to be frequent analgesic users, regarding the safe use of acetaminophen.

6-112

Category: Pain Management

Title: Evaluation of human factors for IONSYS (fentanyl iontophoretic transdermal system) in a simulated use study

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Purpose: Fentanyl iontophoretic transdermal system (ITS) (IONSYS, The Medicines Company, Parsippany, NJ) is a patient-controlled analgesia system indicated for short-term management of acute postoperative pain in adults patients requiring opioid analgesia in the hospital. Fentanyl is delivered through the skin when the patient presses a button twice on the system within 3 seconds. The purpose of this study was to evaluate the effectiveness of the training content for the intended user groups (i.e. nurses, pharmacists, and patients) and the training materials (i.e. Instructions for Use and Disposal, Guide for Patients and REMS guide for nurses and pharmacists).

Methods: All participants were naive users of the fentanyl ITS. Fifteen registered nurses, 16 hospital pharmacists and 15 healthy volunteers evaluated the training regarding the use of fentanyl ITS and then were observed as they completed tasks intended for that user group. The systems used in this study were engineered to be representative samples of fentanyl ITS. HCPs underwent training representative of in-service training (approximately 30 minutes in duration conducted by a representative from the Sponsor modeling a training in-service) before their testing session. Patients received training from the HCPs before their testing session, representative of expected training by the nurse in actual use. This study evaluated the essential daily user tasks for the fentanyl ITS specific to the users interaction with the system: 1) System assembly (HCPs only); 2) Patient training (HCPs only); 3) System application (HCPs only); 4) Dose initiation (patients only); 5) Digital display comprehension (HCPs only); 6) On-system warning statement comprehension (HCPs only); 7) Alert comprehension (HCPs and patients) and 8) End-of-use state comprehension (HCPs only). The study environment simulated the appearance of a hospital room setting. In addition to task failures, close calls and operational difficulties, the study facilitators recorded any other observed issues.

Results: In the HCP group, all successfully assembled the system, successfully trained patients (as evidenced by the patients being able to properly use the system after training), demonstrated proper understanding that the system was only meant for hospital use and needed to be removed prior to discharge; all wore gloves while handling the system, successfully applied the system to a the patient or mannequin, correctly said that the digital display shows how many doses have

been delivered, correctly understood all warnings printed on the product, and correctly indicated when all 80 doses had been delivered and should now be removed with appropriate disposal. Fourteen of 15 nurses and all 16 pharmacists correctly interpreted the 15-second alert as a poor skin contact alert and stated that they should attempt to reattach the system and/or tape it onto the patients skin. In the patient group, all were able to initiate both the first and second doses and correctly identified when the system was alerting and stated they would call for assistance. One patient demonstrated proper understanding of all aspects of product use, but he incorrectly stated that he would continue using the system for up to 24 hours even if discharged.

Conclusion: This study demonstrated that fentanyl ITS can be used by nurses, pharmacists, and patients without encountering use-errors or difficulties that could result in potential harm to patients or injury to other system users, thereby validating the usability of this product, training provided and the training materials in the intended user groups.

6-113

Category: Pediatrics

Title: Standardization of pediatric oral liquid compounds across a large health system

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Purpose: The number of medication errors in the pediatric patient population is typically higher than in adults: one study estimated that 2.4% of pediatric patients experience a preventable adverse drug event involving a medication. Among pediatric medication errors, up to 2.5% cause patient harm. Lack of standardization of compounding recipes and concentrations allows for significant variation in medications to be dispensed and administered. This describes one process of standardizing pediatric oral liquid compounds across a large health system to improve safety and quality.

Methods: An expert panel of pharmacists with a pediatric specialty or extensive experience in pediatrics convened. These members represented the larger childrens hospitals within the health system or facilities that serve a large proportion of pediatric patients. They assessed the utility of The University of Michigan College of Pharmacy state-wide initiative, funded by the U.S. Food and Drug Administration, to standardize the compounding of oral liquids in pediatrics. This panel then provided a gap analysis to determine the disparity of concentrations within the health system as compared to the Michigan standards. Where disparity existed, each member evaluated if a change from the current concentration, to the Michigan standard concentration would be feasible at their site. They also provided additional recipes, in a manner consistent with the Michigan format, to supplement the Michigan website. These recipes are to be posted for all facilities in the health system to access. Once this panel agreed for their facilities to standardize to the Michigan concentrations, the results of their work were presented to executive and clinical leadership for the health system for support in order to require all of the health system to adopt the new standard concentrations of pediatric oral liquid compounds.

Results: Consistent with the recommendations of several organizations, including the Joint Commission, the National Council for Prescription Drug Programs, ISMP, and the WHO: The health system standardized concentrations of compounded pediatric oral liquids by adoption of the Michigan Pediatric Safety Collaboration website as a shared resource (http://www.mipedscompounds.org/). Additionally, commonly used recipes, not available on the website were shared with the health system via a common database.

Conclusion: Advantages to standardizing pediatric oral liquid medications are improved safety and quality and reduced costs. One group of researchers demonstrated an 83% reduction in the number of oral liquid medications available after standardization. Over the course of a year,

representatives from facilities of varying size and locales, were able to come to agreement on a shared resource, standard concentrations for pediatric oral liquid compounds, and provided additional recipes. This work by a few will especially benefit those sites without access to trained pediatric pharmacists.

6-114

Category: Pediatrics

Title: Evaluating The Pharmacist Input Into Education Of Children With Type I Diabetes: Effect on Knowledge and Attitude Outcomes In Specialized Diabetic Center In Khartoum, Sudan

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Purpose: In Sudan, the incidence of type-1 diabetes in children increased over a 4 year period from 5.8 to 10.3 per 100 000 children. The lack of sufficient knowledge about the disease and insulin in addition to illiteracy among the diabetic childrens carers has resulted in poor glycemic control in 86% of Sudanese children with diabetes, consequently led to vascular complications and create enormous economic burden on families This study is to evaluate if pharmacist input into education of type-1 diabetic children will improve childrens knowledge and generate a positive attitude towards the disease and improve their skills regarding insulin usage.

Methods: This prospective intervention study was done at the outpatient department (OPD) of specialized diabetic governmental center in Khartoum, Sudan, and was carried out on 45 type-1 diabetic children (9-16yrs) using non randomized quota technique, from May to August 2014. The main outcome measures were knowledge and attitude. The study was approved by the research committee and informed written consent was signed by the carers after obtaining childrens and parents permission. A questionnaire (pre-test) was used to collect data on socio-demographic characteristics, knowledge and attitude. An educational program was developed, implemented and evaluated by a pharmacist. Children and their carers received 6 diabetes education sessions over a period of 45 days. The effectiveness of the educational program was evaluated by comparing knowledge and attitude outcomes pre and post intervention. Descriptive statistics (frequency, mean, SD, percentage) was used to describe the study variables.

Results: All 45 participants completed the study, of which 62 %(28) were females and 38 % (17) were males .The mean age was (12.4 2.4) and the mean duration of diabetes was (1.71.7) . 87% (39) of the children attended primary school while only 13% (6) attended high secondary level.36% (16) of children had a family history of diabetes and 64% (29) had no diabetes history in their family. Childrens knowledge and attitude had improved significantly as a result of diabetes education intervention by a pharmacist (P-value <0.0005). Pre-intervention the mean knowledge score was (9.2 6.0) which improved to (25.9 2.2) after intervention. The mean attitude score pre-intervention was (33.8 6.6), this improved to (42.14.1) after intervention.

Conclusion: Structured diabetes education designed and provided by a pharmacist substantially improved children with type-1 diabetes knowledge and attitude. This research presents a new

opportunity to include pharmacists in the multidisciplinary teams for the management of diabetes in Sudan aiming to improve the educational services provided to type-1 diabetic children.

6-115

Category: Pediatrics

Title: Evaluation of 3-day versus 5-day azithromycin for the empiric treatment of pediatric community acquired pneumonia

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Purpose: The Infectious Diseases Society of America (IDSA) pediatric community acquired pneumonia (CAP) guideline recommends an empiric 5-day course of azithromycin (5DA) for inpatients of all ages with presumed atypical pneumonia. The recommended regimen is oral azithromycin 10 mg/kg on day 1, followed by 5 mg/kg on days 2 through 5. Although data supports a 3-day course of azithromycin (3DA) (10 mg/kg/day), no studies to date have made the comparison for inpatient pediatric CAP. The primary aim of this study is to determine if 3DA is non-inferior to the recommended 5DA for the empiric inpatient treatment of pediatric CAP.

Methods: This IRB-approved retrospective cohort study was performed at a tertiary care teaching facility. Medical records were reviewed from July 1, 2010 through June 30, 2014. The inclusion criteria included patients admitted to the pediatric intensive care unit (PICU), aged 1 month to 12 years, identification of patients with CAP based on ICD-9 code or signs and symptoms of CAP, and treatment with 5DA or 3DA. The exclusion criteria were antibiotic use within 5 days prior to azithromycin treatment, ages less than 1 month or greater than 12 years, and hypersensitivity to azithromycin or other macrolide antibiotics. The primary endpoints are treatment efficacy and the occurrence, type, and timing of adverse events (AE). Secondary endpoints are PICU and overall hospital length of stay (LOS) and patient readmission within 30 days.

Results: A total of 81 patients were included in this study, 45 (55.6 percent) patients received 3DA whereas 36 (44.4 percent) patients received 5DA. The 3DA and 5DA groups had mean ages of 3.5 years and 4.3 years, respectively. All patients survived to discharge and achieved clinical treatment success (p=1.00). Additionally, all patients received concomitant medications. A total of 58 patients were administered concurrent antibiotic agents; thirty-two patients (71.1 percent) in the 3DA group and 26 patients (72.2 percent) in the 5DA group (p=0.91). Eight patients (17.8 percent) in the 3DA group experienced AE compared to 9 patients (25 percent) in the 5DA group. However, there was no significant difference in occurrence of AE (p=0.43). The 3DA and 5DA groups had gastrointestinal-related AE in 7 (15.6 percent) and 8 patients (22.2 percent), respectively. Patients in the 3DA group had a mean overall hospital LOS 3.3 plus/minus 1.6 days, compared to 3.8 plus/minus 2.1 days in the 5DA group (p=0.36). The mean

PICU LOS for the 3DA and 5DA group were 1.7 plus/minus 1.3 days and 1.6 plus/minus 1.3 days, respectively (p=0.70). There were 2 patients (2.5 percent) with readmission within 30 days of discharge, both being in the 3DA group (p=0.50).

Conclusion: There were no significant differences in treatment success, adverse events, LOS, and readmission rates between groups. Therefore, the results from this study suggest that 3DA may be a potential treatment option in this patient population. However, further prospective studies are warranted in determining if 3DA is a viable option in the treatment of pediatric CAP.

6-116

Category: Pharmacokinetics

Title: Combination of carbapenem and valproic acid will reduce the concentration of valproic acid but not according to the changing of renal and hepatic function

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Purpose: Valproic acid is a first-line monotherapy in inpatients with seizures. Carbapenem is frequently used in hospital to treat serious infections. Some researches reveal that the concomitant administration of carbapenem and valproic acid will result in reducing the plasma concentration of valproic acid. But these data is shortage of patients hepatic and renal function associated with decreasing serum concentration.We will utilize patients hepatic and renal function to look for whether they will effect interactions between valproic acid and carbapenem or not.

Methods: This is a retrospective study. All patients received treatment with valproic acid combined carbapenem from Jan 1, 2014 to Mar 31, 2015 were included. The lack of valproic acid serum concentration is excluded. Data was analyzed by pair-t test and $p< 0.05$ was considered as significant level.

Results: The analysis included 19 events. About the mean standard deviation of Valproic acid serum plasma concentration that decreased from 64 16.8 microg/mL to 22.5 13.7 microg/mL ($P < .001$) with carbapenems. The mean decrease of serum plasma concentration was 65% in Valproic acid. The indicator of renal and hepatic function statistical data that valproic acid combined carbapenem or not were showed, the serum creatine, $p= 0.645$; alanine aminotransferase, $p= 0.155$; bilirubin total $p= 0.366$. All the indicators were no significant.

Conclusion: The interactions between carbapenem and valproic acid will lead to the valproic acid serum concentration drop below the therapeutic range. Our researches indicate patients hepatic and renal function are not difference when decreasing of valproic acid serum concentration. So simultaneous use of both drugs should be avoided as possible as we can.

6-117

Category: Pharmacokinetics

Title: Simultaneous determination of tramadol and its major metabolites in human plasma using isocratic LC-MS/MS and its clinical application

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Purpose: Tramadol is a centrally acting analgesic agent used for the treatment of moderate to severe pain and as an alternative to opioid analgesics. In humans, tramadol undergoes significant metabolism by cytochrome P450s to O-desmethyltramadol (ODT), N-desmethyltramadol (NDT), and N,O-didesmethyltramadol (NODT). The relationships between the concentrations of tramadol and its metabolites, and clinical response remain unclear. This study aimed to develop a simultaneous determination of tramadol and its major metabolites in human plasma using isocratic liquid chromatography coupled to tandem mass spectrometry and to apply it to pharmacokinetic analyses in patients with cancer and non-cancer pain.

Methods: Deproteinized plasma specimens with acetonitrile were separated using a 3.0-μm particle size ODS column with isocratic elution using a mobile phase of 35:65 (v/v) mixture of methanol and 0.15% formic acid in water. The flow rate was 0.2 mL/min at the column temperature 40 degree C. The detection of each analyte was in multiple reaction monitoring transition mode using a triple quadrupole mass spectrometer with electrospray positive ionization. The m/z of the precursor and product ions for the analytes was as follows: tramadol, 264.2/58.1; ODT, 250.2/58.2; NDT, 250.2/232.2; NODT, 236.1/218.4; and tramadol-d6 as internal standard, 270.2/64.1. This validated method was applied to the determination of plasma samples in 15 patients treated with oral tramadol for patients with cancer or non-cancer pain. The study protocol was approved by the Ethics Committee of Hamamatsu University School of Medicine.

Results: Tramadol, ODT, NDT, NODT, and IS were eluted at 6.1, 3.4, 7.4, 3.9 and 6.0 min, respectively. No peaks interfering with analytes and IS were observed. The calibration curves in human plasma of tramadol, ODT, NDT, and NODT were linear over the concentration ranges of 25-3200, 10-1280, 10-1280, and 10-1280 ng/mL, respectively. The lower limits of quantification of tramadol, ODT, NDT, and NODT were 25, 10, 10, and 10 ng/mL, respectively. Their extraction recoveries were more than 85%. The intra-day and inter-day coefficients of variation and accuracy were less than 15% and 85-115% for all analytes. The results obtained with this method met the standards of the international US FDA guidance. The ranges of plasma

concentrations of tramadol, ODT, NDT, and NODT were 342-2236, 28.4-265.1, 20.5-495.8, and 40.2-333.8 ng/mL, respectively.

Conclusion: This study developed a method for the simultaneous determination of tramadol and its major metabolites in human plasma using an isocratic liquid chromatography coupled to tandem mass spectrometry. The present method with acceptable analytical performance can be helpful for evaluating the pharmacokinetics of tramadol including determination of its metabolites for patients with cancer or non-cancer pain in clinical settings.

6-118

Category: Pharmacy Technicians

Title: Effective decentralization of a pharmacy technician to facilitate delivery of discharge prescriptions

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Purpose: The discharge prescription delivery service has been infrequently utilized due to the amount of time it took to fill and deliver prescriptions prior to discharge. As a part of a process improvement project the purpose of this pilot program was to assess the effect of having a certified pharmacy technician (CPhT) present on the cardiology floors who was responsible for collecting, inputting, processing payment, and delivering discharge prescriptions. It was hypothesized that a decentralized CPhT could increase efficiency, decreasing the time for prescriptions to be filled and increasing the number of patients with prescriptions in hand prior to discharge.

Methods: The pilot was conducted from March 2015 to May 2015, Monday through Friday, from approximately 9:00 am to 5:30 pm on the cardiology floors in a tertiary medical center. The CPhT was notified when discharge orders were written and would then go to the patient room to introduce the outpatient prescription delivery service. If the patient wanted prescriptions filled prior to discharge the CPhT would input the prescriptions and coordinate the delivery with the hospitals outpatient pharmacy. If the floors clinical pharmacist was available, he or she would counsel the patient on the discharge prescriptions. In addition, if requested by the patient or it was felt to be clinically necessary the CPhT would wait for the clinical pharmacist to be available for counseling prior to delivering the medications. Data was electronically stored in a secured document. The objectives of this pilot were to assess the percentage of patients with prescriptions in hand prior to discharge, patients motivation for declining the service, the time it took to get discharge prescriptions filled and to the floor, and how often clinical pharmacists were able to counsel patients prior to discharge.

Results: The cardiology units have 56 floor beds that primarily used the discharge prescription delivery service. During the pilot an average of 139 patients used the service a month, which was 50.2% of all patients discharged and 59.8% of all patients discharged with prescription orders. The most common reasons that patients declined the service during the pilot were because discharge prescriptions were not written for (32.6%), the patient wanted to use his or her usual pharmacy (30.3%), the patient was discharged to a skilled nursing facility (14.1%) or the patient was concerned it may delay discharge (11.3%). The number of prescriptions filled a month

increased by 130% during the pilot period. On average, 523 prescriptions were filled a month (approximately 24 per day) compared to 228 (approximately 10 per day) a month prior to pilot initiation (excluding weekends). It took an average of 55 minutes for prescription orders to be input, filled and delivered to the floor compared to 2 hours and 8 minutes during the first week in February 2015. The clinical pharmacist (or pharmacy learner) was able to provide discharge counseling to 47.5% of patients who utilized the service.

Conclusion: Having a CPhT present on the floor to help facilitate collecting, inputting, payment and delivery of discharge prescriptions increased the number of patients with prescriptions in hand prior to discharge and decreased the time to get the prescriptions to the patients bedside. Future directions for this service include expanding to other floors in the hospital, documenting interventions made during the medication reconciliation process, and increasing clinical pharmacist discharge counseling.

6-119

Category: Pharmacy Technicians

Title: Impact on reporting rates of pharmacy quality measures following the implementation of a technician-based documentation initiative

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Purpose: Various regulatory agencies promote the reporting of adverse events (AE) to identify causes and provide solutions to optimize care nationwide. The Improve Pharmacy Reporting Of interVentions, medication Errors, and Adverse Drug Reactions (iPROVE ADR) initiative was implemented in 2011 to increase awareness of underreporting, educate pharmacy staff on AE identification and reporting, and provide training to improve the quantity and quality of events reported. In 2013, it was recognized that many important interventions were being missed by excluding pharmacy technicians from the documentation process. Therefore, the impact of expanding documentation requirements to technicians was evaluated.

Methods: The department of pharmacy services implemented the iPROVE initiative in January 1st, 2012 within the pharmacy. The technicians were educated to be a part of the initiative in October 2013. Using an education module the instructor reviewed the definitions of a medication incident (MI) and reviewed the technician intervention categories and the steps involved in reporting. Technicians were instructed on how to document their findings on a secure, web-based clinical documentation tool. To ensure compliance with program standards, expectations were created with minimums for MI reporting per individual based on employment status. All reporting was to be completed prior to the following months end. Finally, the technician documentation education module was designated as an annual competency. For added incentive, top performers in each category were highlighted within the department and a notation was placed in their personal file. To ensure quality of reporting with MI, pharmacy instructors received generated reports for each event documented. These were reviewed for completeness, accuracy, and follow-up activity. Retraining was provided for individuals who were regularly deficient. MI and intervention data for the 18 months prior to implementation was compared to 18 month data post implementation.

Results: A total of 23 (0.5 percent) MI were reported in the pre-intervention period versus 1236 (17 percent) in the post-intervention period. 3,436 (9 percent) interventions were reported the pre-intervention period versus 68,243 (46 percent) in the post-intervention period.

Conclusion: Requiring technician participation in documentation has resulted in an increase in documentation of MI and interventions by 17 percent and 37 percent, respectively. A limitation of the study was the lack of monitoring for the intervention data for quality. The results have highlighted opportunities for further interventions to improve the quality and safety of care. In addition to tracking the care provided to individual patients, documentation is essential for evaluating the overall impact of the department and allows for ongoing monitoring of outcomes, which generates data essential for continuous quality improvement and recruitment efforts.

6-120

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: To cap or not to cap: clinical case of chemotherapy dosing at extreme body surface area

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Purpose: In 2012 the American Society of Clinical Oncology recommended that full weightbased chemotherapy doses be used to treat obese patients with cancer, particularly when the goal of treatment is cure(1). As a result the Mater Misericordiae University Hospital (MMUH) ceased its practice of capping BSA at 2m2. Mr FM presented to the MMUH in July 2014 with Diffuse Large B Cell Lymphoma Stage 4A and a BSA of 2.78m2 (equivalent to body mass index of 46, category morbidly obese). The treatment of choice was R-CHOP. Pharmacy was consulted by Heamatology regarding the safety of treating to this high BSA.

Methods: Literature review of international guidelines on appropriate chemotherapy dosing in obese patients was completed. Full blood count test results for Mr FM were checked and trended by Pharmacy prior to each cycle of chemotherapy.

Results: Pharmacy advocated using full BSA with close monitoring. Due to a decreased ejection fraction Doxorubicin was substituted with Mitoxantrone (R-CNOP). Mr FM received 6 cycles of R-CNOP with GCSF support followed by 2 cycles of Rituximab. All 8 cycles were given on schedule at 21 day intervals. No treatment delays occurred. Patient had no neutropenic sepsis of note. Patient had a weekly FBC completed. FBC prior to each cycle was found to meet the required treatment limits, i.e. platelets greater than 100x109 L, absolute neutrophil count greater than 1x109 L and haemoglobin greater than 9.5 g/dL. The patient had a complete response to treatment (PET negative) after 4 cycles and is now in remission.

Conclusion: This case report found that the patient tolerated full dose chemotherapy dosed at a BSA of 2.78m2 with no pronounced myelosuppression. The MMUH will continue to follow ASCO guidelines and use full weight based chemotherapy to treat obese patients with cancer.
Reference 1. Griggs JJ et al. (2012) Appropriate Chemotherapy Dosing for Obese Adult Patients With Cancer: American Society of Clinical Oncology Clinical Practice Guideline. Journal of Clinical Oncology 30:1553-1561.

6-121

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Advancing practice without adding resources: How a small, community hospital pharmacy established a full-time Emergency Department pharmacist utilizing its existing staff

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Purpose: The hospital Emergency Department (ED) is a patient care area for which pharmacists can have a positive impact on a number of key pharmaceutical care, medication safety, and patient experience initiatives; however, creating and establishing new pharmacist positions can prove challenging for pharmacy administrators faced with limited resources. This case describes how a pharmacy department in a small, community hospital was able to adjust its practice model in order to place a full-time pharmacist in its ED without expanding its staff.

Methods: Pharmacy administrators first identified an opportunity for pharmacy services to impact patient care in the ED through the collection of medication histories. A pilot study was devised and conducted utilizing an advanced pharmacy practice experience (APPE) student as a pharmacist extender for collection of medication histories; later, a pharmacy resident was dispatched to fulfill this task while rounding with ED physicians as part of a rotation requirement. Through this pilot, physician and nurse recognition of the value of this service created demand to increase pharmacy presence in the ED. Based on this feedback, pharmacy administrators evaluated their departments current practice model and sought opportunities to adjust pharmacists duties to accommodate a full-time decentralized pharmacist to provide services in the ED.

Results: Pharmacy administrators were able to identify inefficiencies in the existing practice model that, once corrected, freed time for higher-priority tasks. Incorporating feedback from the pharmacist staff, adjustments to the practice model included changing staffing templates to eliminate overlap and redundancy, shifting basic clinical monitoring duties to underutilized night-shift pharmacists, and eliminating daily tasks that were deemed to be low impact or clinically ineffective. These practice model adjustments allowed the pharmacy department to mobilize a dedicated pharmacist to work from the ED five days per week with minimal responsibility for centralized pharmacist tasks. / The ED pharmacist has since built a practice of consistent and impactful pharmaceutical care activities, including involvement with medication histories and reconciliation, transitions of care including cross coverage of the intensive care unit, medication management for code blue and stroke teams, antimicrobial stewardship, and patient and staff education. Overwhelming physician and nurse reception of this pharmacist in a new role provided leverage to pharmacy administrators as they sought and obtained approval of an additional, dedicated pharmacist full-time equivalent (FTE) to provide services in the hospitals intensive care and cardiac step-down areas.

Conclusion: In the face of limited resources, launching a pilot program can be the impetus for long-term practice model changes. Utilizing students and/or residents as extenders to the existing pharmacist staff and correcting inefficiencies in current practice models will allow for mobilization of staff to areas of higher priority. Todays successes may be leveraged for future practice model expansion and advancement of practice.

6-122

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Pharmacist interventions can improve clinical outcomes in patients treated with anti-methicillin-resistant Staphylococcus aureus agents in a hematological ward

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Purpose: The therapeutic effects of the anti-methicillin-resistant Staphylococcus aureus (MRSA) agents, vancomycin, teicoplanin and arbekacin are dependent on the blood drug concentration. Therefore, therapeutic drug monitoring (TDM) is an important consideration when these antibiotics are used. In a hematological ward at the Tokushima University Hospital in Japan, ward pharmacists have ordered tests for measurement of the blood drug concentrations of anti-MRSA agents based on an agreed protocol since 2013. Moreover, the infection control team consisting of various medical staffs has advised on the optimal drug dosages since 2013. This study aimed to investigate the effectiveness of these pharmacist interventions.

Methods: Between January 2012 and December 2013, 157 cases received vancomycin, teicoplanin or arbekacin in the hematology ward at Tokushima University Hospital. These cases were divided into the control group treated between January 2012 and December 2012, with no pharmacist involvement, and the intervention group between January 2013 and December 2013, with pharmacist involvement. We retrospectively collected information from medical records and compared their characteristics. We analyzed the rates of optimal drug concentration achievement, fever duration after the start of anti-MRSA agents and the incidences of acute renal injury in the two groups to evaluate the effectiveness of the pharmacist interventions. Moreover, we compared the costs of intravenous antibiotics between the two groups to evaluate the pharmacoeconomic impact by the pharmacist intervention. The costs of intravenous antibiotics were calculated using the total number of antibiotics employed and the drug price at 2013 in Japan. This study was reviewed and approved by the Ethics Committee of Tokushima University Hospital.

Results: There were no significant differences between the two groups with regard to their characteristics. The rate of cases with blood drug levels below the recommended concentration was significantly decreased from 46% to 26% by the pharmacist interventions. Moreover, the rate of optimal drug concentration achievement was significantly increased from 52% to 70% by the interventions. Fever duration was significantly shorter in the intervention group than in the control group (hazard ratio: 1.42, 95% CI: 1.03 1.97). However, no differences in the incidence of acute renal injury were observed in the control (6%) and intervention groups (5%) although

the average blood drug concentrations were increased in intervention groups. The costs of intravenous antibiotics were reduced by 40,729 US$ in the intervention group.

Conclusion: These findings suggested that proactive pharmacist interventions through protocol-based pharmacotherapy management and inter-disciplinary medical support team improved the therapeutic impacts of the anti-MRSA treatments and reduced the costs of treatment in a hematological ward in Japan.

6-123

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: FIP Basel Statements on the Future of Hospital Pharmacy 2014: From Basel to Bangkok

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Purpose: The Basel statements provided the first global, unified vision for the hospital pharmacy profession, developed by key hospital pharmacy stakeholders under the auspice of the International Pharmaceutical Federation (FIP). It has however been seven years since they were first released in 2008, thus, a major revision was considered necessary to ensure these statements remained relevant and reflected contemporary hospital practice and evidence.

Methods: The study was approved by the University of Sydney Human Research Ethics Committee [Approval number: 2013/1005]. The revision process commenced in November 2013 with a global survey to gauge the relevance of each original Basel Statement.. The survey was distributed to members of FIP, national pharmacy associations, and state/provincial associations. The results of the global survey were then reviewed by the FIP hospital pharmacy executive committee to produce a draft version of the revised Basel Statements. The draft was then reviewed by the international hospital pharmacy community through an online forum. The online forum was opened in June, 2014 and an invitation to participate was sent to the same individuals and groups that received the global survey. The online forum remained open until September, 2014. Last, a face-to-face World Caf workshop was hosted at the FIP Global Conference in Bangkok, Thailand on September 4th, 2014 to finalize the revised Basel Statements. At the end of the workshop, participants were invited to share their insights to the whole group and then vote upon the changes. Votes were conducted openly and statements were accepted if they received more than 95% agreement.

Results: In total, 334 responses were received for the global survey from 62 of 194 (32%) of United Nations member nations. In total, 11 statements had more than 10% of respondents indicate that the statement needed to be revised or deleted. By theme, this included 7 overarching statements and 1 for the medicines procurement, 1 for influences on prescribing, 1 for preparation and delivery of medicines and 4 for administration of medicines. Based on these survey results, a draft version of the revised Basel Statements was produced, which included 69 statements. Many of the original statements were removed as they were superseded by the proposed revised statements. In Particular, Statement 1, stating that: hospital pharmacists should optimize patient outcomes through the responsible use of medicines, allowed for the deletion of other statements. New concepts were also added based on medicine-related waste, medical

devices and medicine-related analytics and informatics systems. Participants from 28 countries around the world then reviewed these statements to be presented at the World Caf workshop. A total of 80 participants from 20 countries participated in the World Caf workshop. At its conclusion, the revised Basel Statements 2014 were then voted upon and included 65 statements in total.

Conclusion: The revised Basel Statements 2014 were agreed by a global representation of pharmacists and contained 65 statements. New concepts were introduced as the roles of hospital pharmacists continue to expand.

6-124

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: A survey of Clinical Pharmacy Services in 31 countries in the Western Pacific Region

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Purpose: Clinical pharmacy services have expanded around the world and are becoming increasingly widespread, particularly throughout Asia. This global trend is reflected in International Pharmaceutical Federations (FIP) Basel Statements for the future of hospital pharmacy. To track the implementation of clinical pharmacy services in multiple countries, a survey has recently been validated in the Western Pacific Region (WPR) regarding clinical pharmacy services that influence prescribing based on the Basel Statements. This study aimed to explore the implementation of clinical pharmacy services in the WPR and the factors involved in their successful implementation.

Methods: The study was approved by the University of Sydney Human Research Ethics Committee [Approval number: 2013/400]. Hospital pharmacy directors in the WPR were emailed a link to the validated survey on clinical pharmacy services with the assistance of national hospital pharmacy associations. Surveys were available in English, Japanese, Chinese, Vietnamese, Lao, Khmer, French and Mongolian.

Results: A total of 726 responses were received from 31 countries in the WPR. The majority of respondents, 90.6% (658/726), stated that they provided clinical pharmacy services in some form at their hospital. Regarding the types of services provided by the respondents department, they stated that, on average, 28% of their clinical pharmacists attended patient rounds regularly. They also reported that the median percentage of inpatients receiving a medication history and discharge counselling by a pharmacist was 40% and 30% respectively. Factors affecting the implementation of clinical pharmacy services were identified as either internal or environment facilitators through principal component analysis (PCA). Internal facilitators included items such as the individual pharmacist traits and pharmacy departmental structure/resources while environment facilitators included items such as government support, and expectations from patients and physicians. High internal facilitator scores were identified as significantly increasing the likelihood of hospitals offering clinical services (OR, 1.5; 95% CI, 1.1-1.9) and having pharmacists attend patient rounds regularly (OR, 1.5; 95% CI, 1.1-2.0). High environmental facilitator scores and having a high percentage of clinical pharmacists attend patient rounds regularly was also identified as significantly increasing the likelihood of inpatients receiving a medication history, review and discharge counselling by a pharmacist.

Conclusion: A large majority of hospitals that responded to the survey in the WPR have implemented clinical pharmacy services. Internal facilitators were identified as being important for initiating such services. However, the addition of environmental facilitators and medical round participation by pharmacists was crucial for clinical pharmacy services to be incorporated throughout their hospitals.

6-125

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Assessing Pharmacists' Knowledge Regarding Over-the-Counter Treatment of Insomnia

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Purpose: Retail Pharmacists have quick access to an extensive supply of Over-the-counter (OTC) products. Before recommending an OTC product for the treatment of insomnia, pharmacists should conduct a thorough medical history to guide OTC product selection. The primary objective of this study was to assess pharmacists response to a hypothetical situation involving a patient with acute insomnia. The secondary objective was to assess history taking by the pharmacist.

Methods: The study design involved secret shopper telephone encounters with retail pharmacists. A hypothetical patient with new onset, medication induced insomnia was developed. Study investigators role played as the patient during each phone encounter. A validated questionnaire was used to assess study endpoints. Primary endpoints included the pharmacists ability to identify possible medication related insomnia, the pharmacists recommendation for self-treatment of insomnia, and patient counseling information provided by the pharmacist. Secondary endpoints evaluated history taking (medication history, past medical history, social history, sleep habits, history of current problem). Using a random number generator, 125 retail pharmacies with an active terminal distributors license through the Ohio State Board of Pharmacy were identified. Exclusion criteria were non-retail pharmacies, inactive terminal distributors license, inability to contact the pharmacy by phone, or inability to speak directly with the pharmacist.

Results: A total of 100 retail pharmacies were contacted. Five pharmacists recognized that a prescription medication was a possible cause of the patients insomnia. The majority of pharmacists recommended a non-prescription product: 78 Tylenol PM, 20 Benadryl, four melatonin, and four recommended other treatment options. Of the 78 pharmacists that recommended Tylenol PM, two recommended a dose, 10 counseled on frequency of use, nine counseled on appropriate duration of treatment, and 19 counseled on potential side effects. Three pharmacists provided non-pharmacological recommendations for insomnia. A total of 54 pharmacists completed a medication history. Of those 54 pharmacists, 39 inquired about OTC medications and one asked about herbal medications. Three pharmacists asked about allergies to medications. Study limitations included the inability to make a connection between results and

pharmacist demographics, inclusion of only retail pharmacies in the state of Ohio, inter-rater variability, and small sample size.

Conclusion: The majority of pharmacists did not recognize the potential for drug-induced insomnia. Pharmacists were also incomplete in their history taking and patient counseling. This combination could result in unnecessary costs, drug-drug interactions, and drug-disease interactions. Pharmacists may benefit from education on medication induced insomnia, OTC product counseling points and overall history taking to improve patient care. Future research could include in-person secret shopper encounters and an expanded study population involving multi-state and non-retail community pharmacies.

6-126

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: The economic impact of adopting injectable diclofenac sodium versus injectable acetaminophen for the management of acute postoperative pain: a cost-consequence model from the hospital perspective

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Purpose: While commonly used to manage postoperative pain, opioids are associated with risks for adverse events, including nausea/vomiting, over-sedation, and respiratory depression. Use of non-opioid analgesics (including non-steroidal anti-inflammatory drugs (NSAIDs)) can help to reduce postoperative opioid use and avoid opioid-related adverse drug events (ORADEs). Given its established efficacy profile, intravenous (IV) diclofenac sodium formulated with hydroxypropyl-β-cyclodextrin (HPβCD-diclofenac; DYLOJECT) is expected to reduce opioid requirements versus IV acetaminophen (OFIRMEV). A cost-consequence model was developed to estimate the economic impact from the hospital perspective, over a 1-year time horizon, of adopting IV HPβCD-diclofenac versus IV acetaminophen for management of moderate-to-severe postoperative pain.

Methods: The model was developed on the basis of differential opioid use between current practice, in which IV acetaminophen is used, and the scenario in which IV HPβCD-diclofenac is used. The impact of IV HPβCD-diclofenac adoption was evaluated with respect to ORADE-related, pain medication, and opioid costs. Inputs included numbers of orthopedic or abdominal/pelvic surgery patients, numbers of patients receiving IV acetaminophen or HPβCD-diclofenac, percentages of patients receiving opioids and developing ORADEs, ORADE-associated costs, numbers of pain medication doses, and costs of IV acetaminophen, HPβCD-diclofenac, and opioids. Electronic health record (EHR) database analysis determined the number of IV acetaminophen doses and opioid use rates among patients receiving IV acetaminophen. The number of IV HPβCD-diclofenac doses and opioid use rates among patients receiving IV HPβCD-diclofenac were obtained from pivotal phase III trials. ORADE rates were obtained from the EHR database and published reports. Drug acquisition and ORADE-related costs were derived from published sources. Per-dose IV HPβCD-diclofenac and IV acetaminophen costs were $15.75 and $35.40, respectively. The base-case was defined as a 500-bed hospital performing 2,972 orthopedic and abdominal/pelvic surgeries annually, with 20% of patients receiving IV acetaminophen. The model calculated the cost impact of using IV HPβCD-diclofenac instead of IV acetaminophen.

Results: In the base-case scenario (2,972 patients undergoing orthopedic or abdominal/pelvic surgery, with 594 patients receiving IV acetaminophen), total annual costs (in $USD) were estimated to be $528,790 ($889.62 per patient). The scenario in which 50% of patients received

IV HPβCD-diclofenac instead of IV acetaminophen (297 patients) resulted in a decrease in total annual cost to $430,378 ($724.05 per patient). Total annual savings associated with IV HPβCD-diclofenac adoption were $98,413 ($166 per patient). Savings were attributed to reductions in ORADE-related costs ($37,319), IV acetaminophen and IV HPβCD-diclofenac medication costs ($60,775), and opioid costs ($319). One-way sensitivity analysis, performed by independently varying model input parameters by +/-10% from the base-case scenario, revealed that the parameters with the largest impact on the total savings with IV HPβCD-diclofenac adoption were the percentages of patients receiving IV acetaminophen or IV HPβCD-diclofenac who required administration of rescue opioids.

Conclusion: This cost-consequence analysis demonstrates that adoption of IV HPβCD-diclofenac for the management of moderate-to-severe postoperative pain can result in savings due to reduction in costs associated with ORADEs, pain medication use, and rescue opioid use. Thus, adoption of IV HPβCD-diclofenac presents a potential opportunity for hospitals to improve ORADE-related outcomes and reduce overall costs associated with postoperative pain management.

6-127

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Evaluation of Pharmacy Students Perception and Academic Performance Following Flipping Traditional Lectures in Pharmacotherapy Courses

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Purpose: To determine pharmacy students perception of the value, effect on academic performance, and retention of knowledge after flipping select pharmacotherapy course content.

Methods: Pharmacy students completed a blinded, voluntary 10-question survey on the last day of instruction to assess their perception of the impact of a flipped teaching model which was implemented by two professors in the team-taught cardiovascular, respiratory, gastrointestinal and endocrine pharmacotherapy courses. The 10-questions were added together to create a summated score for each respondent. A respondent had to agree or strongly agree with at least seven of the 10 questions in order to classify them as being satisfied with the flipped model. A nonparametric one-sample Wilcoxon Signed Rank Test was used to determine if there was a significant difference between the sample median and a hypothesized value.

Results: Seventy-two second-year pharmacy students gave consent and completed the survey. Overall, roughly 70% of students in our sample agreed that they support learning content prior to class and using class time for active learning. Although this finding was significantly different from the hypothesized 76% satisfaction rate that is reported in the literature ($p=0.027$), it still supports the trend that pharmacy students are generally satisfied with the flipped classroom model. Approximately 91% of students valued listening to the audio recordings prior to class and 82% of students found using class time for application exercises to be valuable. Performance on exams with this model was comparable to the traditional didactic setting.

Conclusion: Implementation of the flipped classroom in a pharmacotherapy course series demonstrated that students value learning in this model which resulted in comparable academic performance to the traditional lecture method.

6-128

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Evaluation of preventive effect of corticosteroids for rash induced by pemetrexed

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Purpose: Pemetrexed is a novel multitargeted antifolate that inhibits thymidylate synthase, and has highly activity in non-small cell lung cancer (NSCLC) and malignant pleural mesothelioma (MPM). Unfortunately, rashes are more commonly associated with pemetrexed than other chemotherapies, and it is recommended that patients receive corticosteroids for 3 days, including the day of pemetrexed administration (day 1). However, the efficacy of corticosteroids in this context has not been fully verified. In this retrospective study, we assessed whether supplementary corticosteroids reduced the incidence of rash. In addition, we evaluated the association between rash development and the corticosteroid dosage or period of administration.

Methods: We evaluated the medical records of patients who received pemetrexed from April 2009 to March 2014, to confirm whether supplementary corticosteroids prevented rash development. Recorded patient characteristics included age, sex, body temperature, Eastern Cooperative Oncology Group performance status (PS), histology, clinical staging, dosage or period of corticosteroids for 1 week after pemetrexed administration, and the presence of a pemetrexed-induced rash within 3 weeks of treatment. The dosage of supplementary corticosteroids was converted into a corresponding dosage of dexamethasone. Adverse events following pemetrexed administration were evaluated according to the Common Terminology Criteria for Adverse Events version 3.0. This study protocol was reviewed and approved by the Ethics Committee of Tokushima University Hospital.

Results: Total of 134 patients who were treated with pemetrexed were included in this study. Corticosteroids were administered to all patients as clinical practice for anticipated side effects, such as vomiting, nausea, fatigue, and rash. The median age was 67 years (range, 43C84 years), and 27 (20.1%) patients were 75 years old. Regarding the histological type of the cancer, 127 patients (94.8%) had NSCLC and 7 patients (5.2%) had MPM. The incidence of rash was lower in the 113 patients who received supplementary corticosteroids (after day 1) compared with the incidence among the 31 patients who did not receive supplementary corticosteroids (19.4% vs. 38.7%, $p < 0.05$). The average cutoff dosage of supplementary corticosteroids on day 2 and day 3 was 1.5 mg/day of dexamethasone, as calculated using the ROC curve, and the odds ratio (OR) was 0.333 (95% confidence interval [CI]: 0.118C0.937). Furthermore, corticosteroid treatment for 6 days after day 1 was the most effective at preventing rash development (OR: 0.176, 95%

CI: 0.039C0.786). Supplementary corticosteroid was the only factor associated rash development.

Conclusion: These results suggest that 1.5 mg of supplementary dexamethasone on day 2 and day 3 (in addition to day 1) significantly ameliorates the rash induced by pemetrexed. In addition, extending the period of corticosteroid administration results in an even lower risk of rash development.

6-129

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Teaching Adult Learners: An Assessment of Instructional Methods for Health-Systems Pharmacists

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Purpose: Didactic lecture has been the mainstay of higher education for decades. However, the concept of students arriving to class without prior knowledge of the material they will learn does not promote critical thinking, a much needed skill among health care professionals. The idea of a flipped classroom has emerged as a valuable method of instruction at schools of medicine, dentistry, and pharmacy, but has not been well studied in adult learners. The purpose of this study is to evaluate the use of traditional versus flipped classroom method of education for clinical staff pharmacists.

Methods: This was a randomized, single-blind study that included 42 clinical staff pharmacists at a large community hospital. Each pharmacist was randomized to one of two groups (traditional or flipped") to receive education on factor replacement products. The traditional group attended small group meetings, listened to an in-class didactic lecture, reviewed patient cases during the session, and took an assessment at the end of the session. The flipped group listened to a recorded lecture with the same content and completed patient cases prior to attending a small group session. During the flipped session, the cases were discussed and the same assessment was given. All pharmacists were assigned a particular session to attend based on their work schedule. If a pharmacist could not attend the initial session, a makeup session was scheduled so that pharmacist could receive the education in the same manner to which he or she was originally assigned. Pharmacists who were unable to attend any session were not eligible for inclusion in the study. Any pharmacist assigned to the flipped group who did not watch the pre-recorded lecture or complete the cases prior to attending his or her assigned session was excluded.

Results: There were 37 pharmacists included in the analysis, 16 in the traditional group and 17 in the flipped group. The number of years of pharmacy practice was similar between groups; 12 years in the traditional group and 16 years in the flipped group (p=NS). The primary areas in which pharmacists practice (i.e. emergency department, womens and childrens, cardiology, and general medicine) were also similar between groups (p = NS). The average comfort level with indications for use and dosing of factor products was measured on a 10-point scale. Prior to the educational sessions, the average comfort level was 3.7 in the traditional group versus 4.2 in the flipped group (p=NS). After the educational session, average comfort level was 7.3 in the traditional group versus 7.9 in the flipped group (p=NS). Forty-four percent of pharmacists in the

traditional group stated they would have preferred to prepare in advance for the session, while 53% preferred traditional, didactic lecture. Most pharmacists (82%) in the flipped group preferred to prepare in advance, while only 13% preferred traditional lecture. The overall score on the assessment was 70% in the traditional group and 71% in the flipped group (p=NS).

Conclusion: Overall, there were no statistical differences in scores on the educational assessments between groups. Thus, our study did not show that the flipped model of education provided any additional benefit to adult learners compared to traditional lecture, although did not appear to cause harm in the learning environment. A majority of participants, however, reported that they preferred a flipped classroom model as a method of education compared to traditional, didactic lecture. Further studies are needed to evaluate this method of education in adult learners.

6-130

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Effect of text message to improve health literacy on medication adherence in patients with type 2 diabetes mellitus: A randomized controlled trial.

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Purpose: It is critical for diabetes patients to maintain high medication adherence. Moreover, it has been suggested that low health literacy (HL) is associated with poor medication adherence. Thus, HL intervention by using information and communication technology (ICT) like an e-mail might be feasible and effective to improve medication adherence because ICT is very simple and affordable method. This randomized control trial (RCT) aimed to examine the effect of a text message-based HL intervention to promote medication adherence compared with only sending reminder text messages to take or inject medication, in patients with type 2 diabetes.

Methods: This was a single center, open-label, randomized controlled study. Participants who provided informed consent were enrolled at their discharge from April 1, 2013 to March 31, 2014 and followed up 6 months after their enrollment. Eligible criteria of participants were as follows: available to understand the questionnaire in Japanese, older than 18 years of age, previously diagnosed with type 2 diabetes (HbA1c level of >6.5%), obtaining oral or injectable medication, having their cell phone to receive and access text message. HL-related text messages including the prevention of missing doses were simultaneously sent to all participants in the intervention group. On the other hand, participants in the control group only received text messages to remind their medication. The primary outcome was the difference in the change rate of the Morisky Eight-Item Medication Adherence Scale (MMAS-8) that measured the medication adherence at 6 months after initial measurement. The secondary outcomes were the difference in the change rate of each HL score, self-efficacy scores, and HbA1c levels at 6 months from initial measurement. These were carried out as intention-to-treat analyses.

Results: Forty-one participants were randomized into the intervention (n=21) and control (n=20) groups. The difference in the change rate of medication adherence scores at 6 months were 11.8% and 14.2% in the intervention and control groups, respectively, and there was no significant difference between the groups (P = 0.78). Moreover, no significant difference between groups was also observed for the secondary outcomes. In a post hoc analysis stratified by HL score, MMAS-8 scores were more likely to increase in the increased HL score group (functional HL score stratified group: 4.5%, P = 0.77; communicative HL score stratified group:

19.0%, P = 0.18; critical HL score stratified group: 13.5%, P = 0.31; total HL score stratified group: 20.2%, P = 0. 09) compared with the decreased HL score group.

Conclusion: Our results suggested that the text messages, which aimed to promote medication adherence due to improvement of HL, did not significantly improve their medication adherence at 6 months after discharge in patients with type 2 diabetes. However, a simple text message-based intervention may maintain high levels of medication adherence. It is necessary to conduct further study to establish more comprehensive intervention, which improves HL.

6-131

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: An Elective Residency Preparation Course May Increase Student Ability To Acquire PGY1 Pharmacy Residency

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Purpose: The purpose of this study was to determine if participation in a elective residency preparation course enhanced student ability to obtain a PGY1 pharmacy residency

Methods: An electronic cross-sectional survey was sent to all 2014 and 2015 graduating pharmacy students at Idaho State University. Each student received a single link and asked if they had applied for a residency. Students indicating application were then asked to complete the entire survey to determine successful matching as well as if they had taken a residency preparation elective course. The survey also determined the number of residencies applied for, number of interviews received, and levels of comfort or familiarity at each stage of the application process (CV writing, PHORCAS, Letters of Recommendation, etc). All results were collected in a secure electronic data collection service (RedCap) and the authors were blinded to the results of the survey. Chi-square was used to test differences in acceptance rates while the 2-way students t-test was used to test differences in interview rates. IRB approval was not required for this programmatic assessment.

Results: 134 students completed the survey. 49 students indicated applying for a residency with 32 successfully acquiring a residency. 17 students took the residency readiness elective in the fall of 2012 and 2013, 12 of which applied for a residency. 83 percent of students taking the residency preparation course were successful in obtaining a residency compared to 59 percent of students who did not take the course (RR 2.65 p equals 0.1713). Additionally, students taking the residency preparation course had increased interview rates (72 percent vs 53.8 percent, p equals 0.571). Student comfort and familiarity with the ASHP residency application process also tended to favor students who had completed the residency preparation course.

Conclusion: Although not statistically significant, results tended to favor pharmacy students completing a residency preparation course in terms of interview rates, acceptance rates, and comfort/familiarity with application process. Limitations to this study include small sample size and response bias due to students enrolled in the course responding more favorably than those who were unable to enroll.

6-132

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Evaluation of pharmacy students' perceived and actual knowledge in a first professional year (P1) capstone integrated laboratory course

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Purpose: Horizontal integration of professional pharmacy curriculum is desirable to allow for improved knowledge retainment. The first professional year (P1) Integrated Laboratory course at Marshall University School of Pharmacy provides a simulated practice setting where concepts from seven courses (Biopharmaceutics I and II, Biomedical Chemistry, Clinical Immunizations, Pharmacy Practice I and II, and Therapeutics I: Over-the-counter Products) are applied in a laboratory setting. The purpose of this study was to compare students' perceptions of their skill set to their actual knowledge and to determine whether their perceived and/or actual knowledge improved upon completion of the laboratory course.

Methods: This study was approved by the Marshall University Institutional Review Board. P1 students enrolled in the Integrated Laboratory course were asked to take a knowledge perception survey and a short assessment on the first day of lab (baseline) and asked again to retake the survey and assessment on the last day of lab. The survey instrument asked students to rate their confidence levels of their abilities on a four-point Likert scale (strongly agree equals 4, strongly disagree equals 1) in four specific domains: communication skills, compounding skills, calculations, and documentation/labeling of pharmaceutical products. The survey also collected demographic information pertaining to previous pharmacy intern experience and/or Introductory Pharmacy Practice Experiences. The assessment consisted of questions directly related to the surveyed skill sets. Positive correlations between perceived and actual knowledge were compared using parametric methods (Pearson correlation), and significance was evaluated using two-tailed, dependent sample t-tests. An alpha level of 0.05 was used to assess statistical significance.

Results: Correlations between perceived and actual knowledge were significantly correlated at baseline in the communication skills and calculations domains (P is less than 0.001). After the lab had concluded (post-lab time point), perceived and actual knowledge were significantly correlated in all domains (P is less than 0.001). Additionally, students perceptions of their abilities significantly improved from an average of 2.6 at baseline to 3.3 (P is less than 0.001). Overall assessment scores significantly improved from a total percent correct average of 60 at baseline to 78 for the post-lab assessment (P is less than 0.01).

Conclusion: Our P1 capstone, the Integrated Laboratory course, was successful in matching students' perceived knowledge to actual knowledge at the completion of the course. Students' confidence in their abilities and acquisition of skills are essential for producing robust, professional pharmacy students who may practice such skills as interns at the conclusion of the P1 year.

6-133

Category: Preceptor Skills

Title: #thisismylastrotation, #Ihaveajob, #iwanttodoretail: Incorporating self-reflection and social media into an advanced pharmacy practice experience

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Purpose: Preceptors often, particularly close to end of the academic year, notice that students have lost interest in the rotation experience. This phenomenon can be seen even in the start of the year as students may have limited interest in a particular rotation experience. It is a fact, students dont know what they dont know. As preceptors it is our job to inspire interest and passion for our area of practice. Students today are very technology and social media based. We as preceptors have to meet them where they live.

Methods: A self-assessment/reflection tool incorporating a reflection of the students perceived strengths, weakness, opportunity for growth and threats analysis was developed, students are asked to reflect on their prior experiences and their short term and future goals. Rotation activities are then, through collaboration and site capabilities, are tailored to the students needs/goals. In addition as part of the rotation experience students are invited to join a closed group on a social media site, to maintain privacy, and post at minimum on a weekly basis. These posts are encouraged to be a self-reflection of their experience, a fact they learned on rotation, or advice for fellow students.

Results: Eighteen students provided feedback through rotation evaluations over one year. On a four point likert scale (four being strongly agree) students rated this activity on average a 3.17 and overall experience at 3.83. Students commented that the self-reflection exercise was helpful in identifying areas of weakness and in setting goals. They also commented on the benefits of communicating with other students about their experiences through the social media site.

Conclusion: Students have responded enthusiastically to this activity. This rotation experience in a large academic institution provides self-reflection, tailored activities, with the use of social media not only inspires and interests the student today, but also those of tomorrow.

6-134

Category: Preceptor Skills

Title: Preceptor development: assessment, evaluation, and individualized plans for professional development

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Purpose: Preceptor development is a continual challenge for many programs, regardless of size or setting, and is a frequent citing during residency accreditation surveys. Recently, our institution significantly expanded residency programs necessitating an increased number of qualified preceptors. This case describes the methods our institution used to support pharmacists in meeting the American Society of Health-System Pharmacists (ASHP) standards for a qualified preceptor and to promote ongoing professional development.

Methods: All inpatient and ambulatory pharmacists sent a communication to complete an on-line survey. The survey captured the pharmacist experiences in pharmacy practice, education, and research. Rubrics were designed for each preceptor residency standard to determine if a pharmacist fully met, partially met or did not meet a particular standard. A flow diagram was developed, following the ASHP standards, for classifying pharmacists as either qualified preceptor or preceptor in-training. Pharmacists were given a list of individual development plans (IDPs) which corresponded to each standard. Finally, pharmacists are requested to update the on-line site on an annual basis and are considered for promotion to qualified preceptor.

Results: Fifty-eight inpatient pharmacists and 38 ambulatory pharmacists completed the on-line survey. For inpatient pharmacists, the survey capture rate of was 64%. Thirty-five (60%) and 23 (40%) of the inpatient pharmacists were identified as qualified preceptors and preceptors- in-training, respectively. Ambulatory pharmacist survey results are in process of being reviewed. Most preceptors-in- training documented experiences with pharmacy students and have practice sites that involve direct patient care. The most common focused areas for preceptor development plans were precepting and feedback methods, participation in pharmacy organizations, and experience in teaching and research.

Conclusion: Implementation of a resident preceptor survey provided comprehensive information regarding pharmacists experience in pharmacy practice, education, and research. The rubrics assisted with an efficient review of the surveys and rapid classification of each standard. Currently, our residency programs are in the process of updating the survey and rubric to meet the new ASHP PGY-1 standards for qualified preceptors. Furthermore, by individualizing preceptor development plans, the residency programs contributed to the professional growth of the pharmacists.

6-135

Category: Preceptor Skills

Title: Effectiveness and Perceptions of a Reflective Preceptor Development Series in a Residency Program

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Purpose: A pharmacy preceptor development series was created at a large, 695-bed, community-teaching hospital in the Midwest. To determine relevant topics for the series, a needs assessment survey was administered to all PGY-1 and PGY-2 residency preceptors. The program was designed to improve the quality and effectiveness of residency preceptors and consisted of interactive educational sessions delivered during monthly residency advisory committee (RAC) meetings. The purpose of this study was to analyze the effectiveness of this program. Preceptor satisfaction with the program was also assessed.

Methods: This study was classified as exempt by the institutions IRB. Five, 30-minute sessions were facilitated on the following topics: Precepting the millennial generation, dealing with different learning styles, managing time while precepting, handling difficult students/residents, and providing effective feedback. Prior to each session, all participants were provided reading materials to prepare for the discussion. At the start of each session, each preceptor was asked to reflect on their experience with the precepting challenge presented during that session. A brief overview of the topic by the program facilitator ensued. The majority of the session was an interactive, guided discussion. At the end of the session, preceptors were asked to reflect again on how they would use what they learned. To determine effectiveness, a survey was administered to all preceptors prior to the start of the series, which assessed their comfort level with many commonly encountered precepting challenges. This same survey was administered at the end of the series. Each participant completed an evaluation after each program that assessed the following: relevance of the topic, the ability of the program to help them become a better preceptor, the ability of the speaker to facilitate the program, and the value of the format.

Results: When the pre-series survey was compared to the post-series survey, improvement was noted for the percentage of respondents who felt somewhat comfortable or very comfortable handling difficult students/residents (13% vs. 42%, respectively, $p<0.0001$). Improvement was also noted in the following domains, but results were not statistically significant: managing time while precepting (80% vs. 83%, respectively, $p=0.7161$), and adapting teaching style to the learners style (99% vs. 100%, respectively, $p=1.0$). The majority (90%) of preceptors noted that they had changed their precepting style as a result of the preceptor development program.

Overall, the programs were well received by participants, with mean evaluation scores for the programs ranging from 4.45-4.75 out of 5.

Conclusion: Implementation of a reflective preceptor development program at a large, community, teaching hospital was effective in improving preceptors comfort level with several residency preceptor tasks. The programs were also well received by participants.

6-136

Category: Preceptor Skills

Title: Evaluation of the identification of deficiencies in challenging learners by non-faculty preceptors in the experiential pharmacy setting

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Purpose: The purpose of this study was to determine the quantity of challenging learners encountered by non-faculty preceptors at a school of pharmacy, as well as specific competencies the learners lack, and any problem-solving abilities needed in dealing with these learners during their advanced pharmacy practice experiences.

Methods: Following IRB approval, a 12-question electronic survey was administered via e-mail invitation to all non-faculty preceptors at a school of pharmacy. The survey invitation was sent out two separate times to increase likelihood of preceptor participation. For the purpose of this study, challenging learner was used to indicate a student or resident who is performing below the expectations of the preceptor due to a significant concern regarding their knowledge, attitude, and/or skill set. Information on demographics, quantity of challenging learners, type of competency problem identified, personal assessment of competency problem, and difficulty in dealing with competency problem was collected. Data were summarized using descriptive statistics and analyzed for identification of suggested focus areas for preceptor development activities.

Results: Forty-two of 402 (10 percent) preceptors responded to the survey. Participants had practice sites primarily in hospital (45.2 percent) or community/retail (33.3 percent) settings and precepted 1 to 5 (57.1 percent) or 6 to 10 (23.8 percent) students per year. Only 35.7 percent of survey respondents classified 1 or more students from the past year as challenging. These students were primarily identified through personal interaction with the student while on rotation. A majority of respondents (81 percent) felt that the appropriate stakeholders (teacher, learner, or system) were considered when a challenging learner was identified. The most common primary issue noted in these challenging learners was attitude (47 percent); others identified skills (21 percent) or knowledge (10 percent) as the primary issue. The most common types of remediation were informal discussion (45.7 percent), formal evaluation feedback (21.4 percent) and extra assignments focused on problem areas (14.3 percent), with most respondents ranking the remediation method used as somewhat successful or very successful.

Conclusion: This survey identified issues our non-faculty preceptors face regarding challenging learners, primarily attributed to students attitude during rotation experiences. These results will

allow us to implement preceptor development activities to improve preceptors ability to manage attitude problems and improve the management of challenging learners in the experiential setting. Potential limitations of this study include being a single institution study, recall bias, and student overlap. Small sample size and low overall survey participation by non-faculty preceptors present other potential limitations as only 42 non-faculty preceptors (out of 402) participated.

6-137

Category: Psychotherapy / Neurology

Title: Impact of a pharmacy developed education course at a mental health facility

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Purpose: Medication adherence is a significant challenge to healthcare providers as nonadherence leads to disease progression, hospital readmission, and increased medical expenses. To date, the majority of studies have focused on the impact of medication education courses on adherence rates in patients with diabetes, heart failure, and asthma. Here we report one of the first analyses on the impact of a pharmacy-developed, multi-tiered medication education course on patient attitudes about medications and implications for medication adherence rates at a mental health facility.

Methods: This study was conducted at a 35-bed behavioral health center from December 2014 to April 2015. Eligible patients included those aged > 18 years admitted to St. Josephs Behavioral Health Center and attended medication education courses. Exclusion criteria included patients who refused to complete a Drug Attitude Inventory-10 questionnaire (DAI-10). Patients admitted at St. Josephs Behavioral Health Center participated in a three-tiered medication education program. Tier 1 consisted of medication education classes led by nursing staff three times weekly. Patients were asked to complete a DAI-10 questionnaire to assess initial attitudes toward medications at the beginning of the class. Tier 2 consisted of individual consultations by pharmacists with patients who had specific concerns they wished to explore or patients who were identified to be at-risk through assessment of their DAI-10 questionnaire scores (DAI-10 score < 0). Tier 3 consisted of individual consultations by pharmacists with patients who were readmitted during the study period. During pharmacy consultations, patients were asked to complete the ASK-12 questionnaire to identify and discuss any barriers to adherence. At discharge, patients were asked to complete a secondary DAI-10 questionnaire to assess the impact of the multi-tiered medication education program on attitudes about medications.

Results: A total of 172 patients attended Tier 1 of the medication program. Of these patients, 45 patients were excluded. Of the 127 patients included, 31 patients were eligible to participate in Tier 2 of the program of which 23 patients received pharmacy consultations, and 23 patients were eligible to participate in Tier 3 of the program of which 16 patients received pharmacy consultations. Not all patients were able to receive pharmacy consultations due to time limitations. The average DAI-10 score prior to participating in the medication education program was 3.24, and upon discharge was 5.89 ($p<0.0001$). Of the patients that participated in Tier 2/3 of the program, the average DAI-10 score prior to participating in the medication education was 0.59, and upon discharge was 4.97 ($p<0.0001$). When comparing Tier 1 participation only to Tier 2/3 participation, the average change in score was found to be significantly greater when patients

participated in Tier 2/3 of the program vs. Tier 1 participation only (change in DAI-10 score for Tier 1 vs Tier 2/3 - 1.63 vs 4.97, respectively, $p<0.001$). Of the patients that participated in Tier 2 and Tier 3 of the program, the most common barrier to adherence was treatment beliefs.

Conclusion: The multi-tiered medication education program proved to be an effective method of identifying and targeting at-risk patients to improve patient attitudes toward medications. Additionally, individual pharmacy consultation had a greater impact on patient attitudes versus group lead medication classes.

6-138

Category: Psychotherapy / Neurology

Title: Second generation antipsychotic prescribing patterns in an acute inpatient psychiatric setting

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Purpose: The incidence of metabolic syndrome has increased significantly over recent years. Risk factors for metabolic syndrome include central obesity, low high-density lipoprotein, elevated triglycerides, high fasting plasma glucose and high blood pressure. Second generation antipsychotics may contribute to the likelihood of developing metabolic syndrome due to adverse effects such as weight gain and hyperglycemia, although risk differs within the class itself. Therefore, patient risk factors should be considered when selecting a second generation antipsychotic.

Methods: A retrospective review of medical charts of patients, 18 years or older, who were admitted to an acute inpatient psychiatry unit at an academic medical center, and ordered at least one scheduled second generation antipsychotic was conducted. Each metabolic risk factor (diagnoses of hypertension, diabetes, hyperlipidemia and a body mass index greater than 30) was assigned a value of 1. These values were totaled to determine the patients metabolic syndrome risk factor score (high risk greater than or equal to 2, low risk less than or equal to 1). Patients were divided into two groups, accordingly, based on this score. Clozapine and olanzapine were categorized as the second generation antipsychotics with a high risk for causing weight gain and diabetes, risperidone and quetiapine were moderate risk, and all others were considered low risk. Demographic data including age, gender, race, height, weight, comorbidities, and treatment naive versus non-naive status was also collected. A chi square test was used to compare the two groups in regard to type of second generation antipsychotic selected, gender, and race, while an independent t-test was used to analyze the differences among the groups in terms of age.

Results: A total of 300 patients were included in the analysis and subsequently divided into high (n equals 57) and low (n equals 253) risk groups based on their risk factor score. For the low risk factor group, 10.7 percent, 55.1 percent, and 34.2 percent were prescribed a low, moderate, or high risk second generation antipsychotic, respectively. For the high risk factor group 17.5 percent, 56.1 percent, and 26.3 percent were prescribed a low, moderate, or high risk second generation antipsychotic, respectively. There was no significant difference between the two groups in terms of the type of second generation antipsychotic selected (p equals 0.262). Equivalence between groups was shown through a chi square analysis of gender (p equals 0.68) and race (p equals 0.65). The demographic variable of age, however, did show a significant

difference with those in the low risk factor group having a lower mean age compared to those in the high risk factor group (42.5 versus 51.9, p is less than 0.01).

Conclusion: The data suggests that prescribers do not consider metabolic risk factors when prescribing high risk second generation antipsychotics such as clozapine and olanzapine. Physicians may face challenges in determining best second generation antipsychotic selections based on an individuals risk for developing metabolic risk syndrome. Therefore, it may be beneficial to further educate prescribers on the associated risk of metabolic risk factors of each second generation antipsychotic in efforts to improve clinical decision making.

6-139

Category: Psychotherapy / Neurology

Title: Osteoporosis risk in adult patients using short and long term therapies with selective serotonin reuptake inhibitors

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Purpose: Osteoporosis is the most common bone disease and affects more than 9.9 million Americans. Additionally, 43.1 million have low bone density possibly turning into osteoporosis. Fractures attributed to osteoporosis contribute to higher healthcare costs. The association of selective serotonin reuptake inhibitors (SSRIs) and risk of osteoporosis, bone fractures and bone mineral density (BMD) levels has been inconclusive and no studies have evaluated if length of therapy with SSRIs may play a role in these outcomes. The purpose of this study was to determine the prevalence of osteoporosis, bone fractures and BMD levels in patients using SSRIs short and long term.

Methods: A secondary data analysis was conducted using the cross-sectional health questionnaire, prescription medication use profile and physical examination data from the National Health and Nutrition Examination Survey (NHANES). Adults 20 years and older from survey cohorts 2003 through 2010 were included in the study. Subjects were divided into three study groups based on SSRI use and length of time taking therapy. Those who reported the use of SSRIs in the past 30 days from survey interview were classified into either those taking SSRIs for less than a year or those taking SSRIs for one year or longer. The control group included those who did not report using SSRIs. Three outcomes were evaluated separately: 1) history of osteoporosis, 2) history of broken or fractured hip, wrist, or spine, and 3) bone mineral density t-scores (either normal, osteopenic or osteoporotic). Chi-square and one-way analysis of variance (ANOVA) tests were performed to compare demographic and clinical variables across study groups. The chi-squared test was used to examine the association of SSRI use groups and the three study outcomes (alpha equals 5 percent). All estimates are representative of the national non-institutionalized civilian population.

Results: Among the subjects included in the study (n equals 22,173), the average participant was non-hispanic white, 46.7 years old, had low dietary calcium and vitamin D, low levels of calcium, and had prescription and health insurance coverage. There was a significant association between SSRI use groups and a history of osteoporosis (p is less than 0.0005), and rate of total fractures (p equals 0.001). When compared to the control group, prevalence rates of osteoporosis and fracture history were higher among those using SSRIs greater than or equal to one year (5.5

to 3.9 percentage points higher, respectively). Rates of osteoporosis history were highest for those using SSRIs greater than or equal to one year at 10.6 percent. The bone mineral density t-scores revealed that those taking SSRIs for greater than or equal to one year had the highest rates of osteopenia and osteoporosis combined at 41.1 percent compared to those using SSRIs for less than one year and the control group at 29.9 percent and 36.8 percent, respectively but there was no statistical association (p equals 0.98).

Conclusion: The use of SSRIs was associated with a history of osteoporosis and fractures. In order to reduce the risk of bone disease, it is important for healthcare providers to monitor bone health in those patients taking SSRIs long term.

6-140

Category: Quality Assurance / Medication Safety

Title: Assessment of the daily safety/operations huddle of a pharmacy department

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Purpose: Real time, widespread communication of safety and operations issues is vital to the provision of optimal pharmaceutical care and services, and a daily huddle is an effective tool to meet that need. By surveying the staff we hoped to identify how well this tool was meeting those needs and how the tool could be improved at our hospital.

Methods: In August 2014 we implemented a daily safety/operations huddle. This huddle is held 7:05am every morning bridging night and day shift. It is held in the central pharmacy, but there is also a phone option so that those that cannot be physically present can listen and participate. The huddle highlights issues that have arisen in the past 24 hours or are projected in the next 24 hours. The issues are merely described; if problem solving is necessary it is addressed off-line. Notes from the huddle are immediately stored on the department website, available to all staff. Standard items discussed include employee recognition, patient safety reports, staffing issues, and equipment/technology issues. Other specific items that have been discussed include daily hood cleaning documentation, The Joint Commission pearls in preparation for our survey, look-alike sound-alike/high-risk medication quizzes, imminent shortages/outages, and immediate lab or nursing issues. In March 2015 we solicited feedback from the staff with a 10 question REDCap survey (The REDCap Consortium). Survey questions assessed staffs opinions related to the daily huddles effectiveness, and efficiency. The survey also addressed usefulness of the huddle on weekends compared with weekdays. This survey was approved by the University of Florida IRB and granted exemption.

Results: There were a total of 46 respondents out of a total of 195 pharmacy department employees. 58.7% found the huddle to be either somewhat or very effective at improving patient safety by sharing communication between the shifts. 67.4% and 63.1% somewhat or strongly agreed that the huddle informed them about safety and operations issues, respectively. 87% felt that the timing of the huddle did not or somewhat interfered with their work. 58.7% rarely or never went to the website to look at the notes. 65.2% responded that, when working during the weekend, they would call into the weekend huddle 0-25% of the time. Based on these results it was determined that a majority felt the huddle provided value from a safety and operations standpoint. Further, based on the data it was recommended to continue the huddle daily at 7:05am, but to discontinue regular scheduling of the huddles on weekend/holidays due to low participation. It was also recommended to discontinue posting the daily notes on the website, but rather emailing to the department immediately following the huddle.

Conclusion: A daily safety/operations huddle was perceived by our pharmacy staff as improving patient safety by improving communications between shifts. They felt more informed about safety and operational issues. Improvements have been recognized by our staff and those changes have been integrated in to our daily huddle. A survey was an effective tool to assess our daily safety/operations huddle and to better meet the needs of our staff.

6-141

Category: Quality Assurance / Medication Safety

Title: The role of pharmacist in antimicrobial stewardship program in VGHTPE (Taiwan)

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Purpose: Multidrug-resistant organisms are recognized as a global public health issue. Antimicrobial resistances are worldwide challenges to the treatment of infectious diseases. In Taiwan, the Centers for Disease Control conduct a 3-year antimicrobial stewardship program since 2013, in order to establish institutionalized policy of antibiotics management, to optimize the use of antibiotics, and to reduce antimicrobial resistances. VGHTPE is one of the seven hospitals which are chosen as demonstration center, to execute the task of setting up criteria and helping other hospitals to carry out. This post is to demonstrate the role of pharmacist in antimicrobial stewardship program in VGHTPE.

Methods: The essential members of VGHTPE antimicrobial stewardship are infectious-diseases physicians, pharmacists, clinical laboratory technologists, infection-control nurses and computer technologists. The tasks of pharmacists are as follow: (1) Working within the pharmacy and therapeutics committee, to ensure the number and types of antimicrobial agents are appropriate for the patients; (2) Working with the computer technologists, to set up the prescription restrictions of antimicrobial agents and prescription error-proofing mechanisms on the computerized physician order entry (CPOE) systems which will help to optimize the use of antibiotics; (3) Providing clinical service such as attending ward rounds and evaluation antimicrobial prescriptions; (4) Monitoring antimicrobial agents use and analyzing the quantitative data; (5) Providing consultation and patient education of antimicrobial agents.

Results: Since participating the program, we made efforts to execute the tasks, here are some achievements we made: (1) Setting up several prescription error-proofing mechanisms on the CPOE systems, such as the check system of antibiotics use in upper respiratory disease, the link to the treatment guidelines of infectious diseases, alerts of monitoring therapeutic range of vancomycin and aminoglycosides in inpatients. (2) Evaluating antimicrobial prescriptions (retrospective case random review in outpatients, prospective on-time review antimicrobial prescription in inpatients) and feedback to the prescribers. The appropriate rate of antibiotic use in outpatients is increased from 82% to 93.5%. The average evaluating rate of inpatients antimicrobial prescription is about 60-65%. (3) In order to efficiently monitor antimicrobial agents use, we used SAS-VA to analyze the data, and it seemed that the antibiotics consumption

is decreased gradually. (4) Conducting several educational lectures for the patients about what is antibiotics and how to take the medicine correctly.

Conclusion: The antimicrobial stewardship in VGHTPE is a well co-operated teamwork and the pharmacists play an important role in it. After participating the CDCs 3-year antimicrobial stewardship program since 2013, we work hard and get some achievements. Although the program will be finished this year, but the VGHTPE antimicrobial stewardship will keep going, and making efforts on antibiotics management.

6-142

Category: Quality Assurance / Medication Safety

Title: Raman spectroscopy: a robust technique for determining accuracy of extemporaneously compounded pharmaceutical formulations

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Purpose: Raman spectroscopy is a novel technique to identify chemical entities using a unique chemical fingerprint that is created by observing vibrational, rotational, and other low frequency modes of chemicals. Use of this technology promises to provide the compounding pharmacist with the capability to simply provide quality control to compounded formulations. The specific aim of this study is to develop and validate a Raman method to accurately identify and quantitate active pharmaceutical ingredients and their respective excipients in extemporaneously compounded pharmaceutical formulations.

Methods: A novel Raman spectrometer was interfaced to a Dell Latitude E7250 computer and calibrated for use. Nine non-sterile extemporaneously compounded pharmaceutical formulations (Cook Childrens Medical Center, Ft Worth, TX) were obtained and analyzed to create a library of unique Raman spectral displays (intensity vs. wavenumbers). The resulting standard displays for the nine formulations were used as reference standards to identify other like formulations. A match of spectral displays was determined with correlation coefficient (r) values greater than 0.90. We evaluated Ramans ability to correctly identify the respective compounded pharmaceutical formulation using a total of 110 unknown samples to calculate predictive values. The sensitivity, specificity, and positive (PPV) and negative (NPV) predictive values for the Raman test method are calculated using a standard 2 x 2 block analysis. In addition, the content of the active pharmaceutical ingredient (API) of each compounded pharmaceutical formulation that was correctly identified was compared to the desired content contained in the standard formulation. Whereas, the API intensity measure of the correctly identified formulation was compared to the respective standards intensity measure.

Results: Operation of the CBEx instrument was simple and testing was easily completed within 10 - 20 seconds. Within the limits of our study design, method sensitivity and specificity were 100 and 91percent, respectively. The predictive value of the CBEx instrument was very high; the PPV was 98 percent and NPV was 100 percent. The accuracy and precision of the API concentration was measured to be within 10 percent of the actual standard formulation with a less than 5 percent RSD.

Conclusion: Use of the CBEx instrument to accurately identify extemporaneously compounded pharmaceutical formulations has been demonstrated to be simple to operate and highly predictive. We believe that use of the instrument can be cost effective and easily implemented for purposes (1) to provide quality control, (2) to detect drug diversion, and (3) to document API stability. Further study is warranted to identify Raman method limitations and develop standard operating procedures (SOP) for compounding pharmacies.

6-143

Category: Quality Assurance / Medication Safety

Title: Making it safer introducing a standard calculation protocol in an Israeli hospital

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Purpose: High alert medications are associated with a high incidence of drug related problems (1). According to the Israeli Ministry of Health' (MOH) accreditation rules (2,3,4), dosage calculation of high alert drugs must be performed by two independent staff members. In order to work according to procedures without any additional medical staff , pharmacists developed a calculator (in excel format) that helps the nurse to recheck calculations and approval . Objective To create and evaluate the usefulness of a new calculation tool that allows accuracy and availability to nurses that administer high alert drugs.

Methods: The application is based on excel format which was checked and approved by the drug and therapeutic committee. Standard dilutions for all those drugs were approved as well. The calculator can transform the medical instruction (giving in the units approved mg/kg/min) to administration orders for nurses: which drug, how to dilute it and on what rate to give it.

Results: After the application was created, a pilot was performed in one department. The application was found to be accurate and easy to use.

Conclusion: Interpreting the physician order of an high elert drug has to be accurate while minimizing the hazard of human errors. In order to ease and optimize the procedure, we developed an application that allows a safe patient 'treatment.

6-144

Category: Quality Assurance / Medication Safety

Title: Evaluation of the inappropriate continuation of stress ulcer prophylaxis upon discharge at a tertiary care teaching hospital

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Purpose: The majority of patients admitted to the intensive care unit (ICU) are at risk for stress ulcer development due to risk factors such as mechanical ventilation or coagulopathy. Subsequently, stress ulcer prophylaxis is initiated with the administration of a histamine H2 receptor antagonist (H2RA) or a proton pump inhibitor (PPI). Frequently, the prophylaxis regimen is continued throughout the entire hospital stay and then continued upon discharge. The objective of this medication safety project was to determine how many patients were discharged home with an inappropriate continuation of stress ulcer prophylaxis.

Methods: This retrospective medication reconciliation study was completed at a tertiary care teaching hospital. The study evaluated all patients admitted to the medical ICU between October 1, 2014 and November 30, 2014 who received at least 1 dose of famotidine (H2RA) or pantoprazole (PPI). Inclusion criteria included survival to discharge, admission to the medical ICU without a prior history of H2RA or PPI use, initiation of famotidine or pantoprazole in the ICU, and a documented indication of stress ulcer prophylaxis. Patients were excluded if they did not meet the above criteria or were still inpatients at the time of data collection. The primary outcome of interest was the number of medical ICU patients that were inappropriately continued on stress ulcer prophylaxis upon discharge. Summary statistics were used to evaluate the data.

Results: A total of 217 patients were admitted to the ICU during the study period and received at least 1 dose of famotidine or pantoprazole. Of those 217 patients, 171 patients (78.8 percent) survived to discharge. Out of those patients who survived to discharge, 87 patients did not have a prior history of H2RA or PPI use, had famotidine or pantoprazole initiated in the ICU and had a documented indication for stress ulcer prophylaxis; these 87 patients became the analytic dataset. Overall, 34 out of the 87 medical ICU patients (39.1 percent) that were initiated on famotidine or pantroprazole solely for the indication of stress ulcer prophylaxis were continued throughout the admission and ordered at discharge with no indication for continued therapy.

Conclusion: Stress ulcer prophylaxis is warranted in the ICU when the patient has risk factors for the development of stress ulcers, such as mechanical ventilation. However, as these results demonstrate, the medication reconciliation should be closely evaluated upon discharge to ensure

that medications are discontinued when they are no longer clinically warranted. The immediate positive outcome for the patients may include decreased costs, decreased use of unnecessary medications, and decreased long-term side effects.

6-145

Category: Quality Assurance / Medication Safety

Title: Analysis of pharmaceutical care report, named as gPreAVOID reporth, in Gunma prefecture JAPAN

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Purpose: Recently, regional disparities on the the awareness of safety management in medicine have been focused as one of problem while, medical level has been highly improved, and increase of the level of each regional medicine is required to solve regional disparities in Japan.

Methods: Since 1999, Japanese Society of Hospital Pharmacists, JSHP, has maintained a spontaneous-reports database that contains nearly 200 thousands pharmaceutical care reports which were performed by pharmacists to avoid or reduce the risk of disadvantages according to pharmaceutical therapy. Those pharmaceutical care are called as gPreAVOID, be PREpared to AVOID the adverse drug reactionsh in Japan, and its database is used to create pharmaceutical information, enhance information sharing and promote pharmaceutical care with higher level. Then, Gunma Society of Hospital Pharmacists established individual PreAVOID reports database in Gunma prefecture at 2001 and have analyzed and disclosed its information to improve the pharmaceutical care and facilitate closer information sharing among pharmacists in Gunma by assessing the difference of pharmaceutical care level between throughout Japan and Gunma.

Results: The number of PreAVOID reports reported in Gunma in 2014 was increased 5-7 fold compared to that in 2000. Most of them were reports of pharmaceutical care which succeeded in avoiding serious adverse drug reactions. Over 80% of those reports were made by clinical pharmacists, and most were started with assessment of clinical test data or reconciliation of brought medicines by patients which were currently taken by each patient. These results indicate that our approach make sharing information of pharmaceutical care in Gunma much closer and increase the level of pharmaceutical care performed by pharmacists.

Conclusion: In future, we will assess more detail of reports to increase pharmaceutical care level, and promote safety management in medicine with global standard level by comparing our reports to that made in the world.

6-146

Category: Quality Assurance / Medication Safety

Title: Pediatric pharmacy leading the way in preventing medication errors: using high reliability principles to increase compliance of bar-coded medication administration (BCMA)

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Purpose: Bar-coded medication administration (BCMA) is a process designed to reduce the number of medication errors that occur during administration. The technology is only of benefit if utilized appropriately by nursing and respiratory care staff. Compliance is dependent on functional equipment, software, and educated care providers. Pediatric medications are frequently unavailable in commercially produced preparations, which often require modification, and therefore lack manufacturer barcoding. Absence of traditional barcoding increases the complexity of BCMA implementation in a pediatric hospital. Combined, these issues can cause a reduction in nursing and respiratory staff compliance with BCMA.

Methods: The pediatric pharmacy department implemented multiple initiatives designed to increase nursing and respiratory care BCMA compliance. Several communication methods were developed for staff reporting. These issues were reviewed and corrected by pharmacy staff in real time. A multidisciplinary task force was created to communicate compliance data and develop ideas for improvement. Good catches, lessons learned, and division specific data were all shared at the hospital-wide medication safety and therapeutics committee meetings. Findings and outcomes from these meetings were reported to management and front line staff. An active list of scan-able, non scan-able, pending, and resolved medication issues was maintained and distributed on a biweekly basis via a leadership led organizational safety brief. Pharmacy and hospital quality staff engaged nursing and respiratory care staff through scheduled walk rounds to follow up on staff compliance deficiencies, as well as gain feedback of any problems with equipment, software, or medication bar codes. The non-punitive rounds were guided by data and increased trust and rapport that strengthened improvement efforts. Three main data points were tracked and shared with staff: percent of total doses successfully scanned, percent of total doses not successfully scanned, and the percent of total doses administered, bypassing the BCMA process.

Results: Successful BCMA scans increased from an initial average baseline of 60 percent at implementation in September 2013, to the current average of 85 percent in June 2015. Unsuccessful BCMA scans decreased from a baseline of 7.6 percent to 5.5 percent in the same time frame. Complete bypasses of the BCMA system decreased from a 30.4 percent at baseline to a current level of 9.5 percent.

Conclusion: The pediatric pharmacy's role in BCMA as part of a hospital wide implementation goes beyond maintenance and medication distribution. Pharmacy-driven compliance efforts resulted in a significant improvement of nursing and respiratory care compliance with process utilization. The evidence in the data suggests that coupling the use of technology and the implementation of high reliability methods can create a culture that drives individual behaviors to achieve a safer environment for the patients who receive medications within a pediatric hospital.

6-147

Category: Quality Assurance / Medication Safety

Title: Evaluation and expansion of the medication history process in a community hospital setting through proposal and implementation of a medication history technician program

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Purpose: Complete and accurate medication history evaluation is a vital component to medication safety and error prevention. In a community hospital with 170 inpatient and 36 emergency department beds, the current process for obtaining medication histories is primarily nursing and physician driven with pharmacists available on a consult basis. Pharmacists identified a gap in pharmacy services and sought to fill the need for pharmacy personnel completing medication histories through a medication history technician program. This program was implemented in efforts to provide the best quality patient care possible as well as aid in the development of future pharmacists.

Methods: This program was developed through a tri-phasic system. Phase I included the evaluation of the current process of obtaining medication histories both in the emergency department and inpatient units. This evaluation showed a limited systematic approach for obtaining complete and accurate medication histories in all hospital locations. Subsequently, Phase II consisted of the development and implementation of a standardized process for obtaining medication histories by pharmacy personnel. The process included documentation of medication histories, clarification of allergies, and communication of information to other healthcare providers. Lastly, Phase III involved proposing the role of a medication history technician to pharmacy department management for approval followed by solidifying key qualities needed for ideal candidates. Pharmacy students were selected for these positions as a cost-effective personnel option for the department as well as providing inpatient hospital experience to future pharmacists. The primary endpoint of implementation examined the percentage of patients with erroneous medications identified and reconciled for administration by the medication history technicians over a four week time period. Secondary endpoints included the volume of medication histories completed. Reports were obtained from the electronic medical record identifying completed medication histories and electronic staff messages.

Results: Three part-time employment positions were offered to third and fourth year pharmacy students. Over a four week period of time, three medication history technicians interviewed patients in both the emergency department and inpatient units with complete evaluation of 162 medication histories. All medication histories were updated with information provided by numerous resources including patient or family interviews, pharmacy prescription refill histories, prescription bottles, and transfer facility records. Of the medication histories that were reviewed, 27% of patients were identified to have erroneous medications listed on the prior to admission

medication list and subsequently were reconciled incorrectly for inpatient administration. These errors were communicated through the electronic medical record to the pharmacist on duty and were addressed according to hospital protocols. Admitting physicians were notified as clinically warranted. Overall, the implementation of a medication history technician program increased the number of medication histories completed by pharmacy personnel, identified erroneous medications, and communicated discrepancies to physicians for medication reconciliation. Utilizing pharmacy students in this role also allows the program to foster and develop the skills of future pharmacists through direct patient care experiences in a community hospital setting.

Conclusion: In conclusion, obtaining medication histories for patients in a community hospital setting is a vital component to medication safety and error prevention. To address a gap in patient care, a medication history technician program was proposed and developed through a tri-phasic systematic approach which led to the development and implementation of the program as well as the identification and training of qualified candidates. Overall, expanding pharmacy services through this medication history technician program provides additional pharmacy resources to complete accurate medication histories and provide an inpatient pharmacy experience for pharmacy students.

6-148

Category: Quality Assurance / Medication Safety

Title: Evaluation of Risk Evaluation and Mitigation Strategy Compliance in the UAB Hospital Infusion Clinics

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Purpose: In order to provide continuity in care to each patient of the UAB Infusion Clinics, the purpose of this project is to evaluate and identify the compliance of UAB Hospital Infusion Clinics to the FDAs REMS requirements for medications dispensed. Necessary measures will be implemented to increase compliance in the Infusion Clinics.

Methods: The first step in this project was to evaluate the UAB Infusion Clinic formulary for medications requiring REMS for their appropriate dispensing. Following identification, the individual REMS components were thoroughly reviewed and mapped out to increase overall data collection standards. The Infusion Clinic formulary agents requiring REMS were reviewed for all cases to maximum of 15 encounters for a 90 day period for proper documentation of REMS components in the available electronic medical records and paper charts. Of the total 233 patients receiving REMS medications, 101 patients were included in the 90 day review. Following data collection, compliance will be increased through necessary intervention. Compliance will be monitored in the future through an audit process performed by the department of pharmacy.

Results: Twelve medications met inclusion criteria for the 90 day review due to REMS requirements of dispensing. Of the 12 medications reviewed, 7 medications carried communication plan requirements for the relay of risk associated with a medication to be released on the market. Documentation of clinical indicators, or adverse/secondary event monitoring was a large area for improvement with only 3% documentation rates on the 2 medications involved. Documentation of restricted distribution to pharmacies enrolled to receive specific medications was the most compliant area at 100%. Medication guide delivery on each infusion, a requirement for 5 medications, was again a large area for improvement with only 2% documentation recorded. Patient registry was compliant with 93% of cases on the 4 medications requiring. Provider training was required for 4 medications and was compliant for 89% of the cases. Nursing management and clinical informatics was consulted on ways to improve the documentation standards of the Infusion Clinics. Appropriate education will be given to clinical staff to improve compliance. A single page resource flyer will also be distributed to the infusion clinics directing staff to the most up to date REMS material. Compliance will be monitored in the future by audits performed by pharmacy personnel.

Conclusion: This project evaluated the necessary compliance to the FDAs REMS requirements and identified areas for improvement. Integration with the Infusion Clinic staff allows this project to further increase patient care quality in addition to adherence to federal standards set forth. Documentation in the areas of clinical indicators and medication guide distribution should improve the greatest following this project due to the change in documentation methods through

the electronic medical record. Medication safety remains of utmost importance while complying to the FDA standards set forth.

6-149

Category: Quality Assurance / Medication Safety

Title: Impact Of Clinical Pharmacist and Charge Nurse Daily Huddle On Improving Core Measures At A Tertiary Referral Hospital

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Purpose: Pharmacists are a vital part of the healthcare team in the inpatient setting, but their impact on improving core measures has not been clearly defined. In 2013 the study facility was falling behind the rest of the nation in core measures. The Centers for Medicare and Medicaid Services established core measures based on evidence-based quality indicators that have been shown to reduce the risk of complications, prevent recurrences, and promote optimal treatment of patients with particular conditions. The objective of this study was to measure the impact of clinical pharmacist's involvement on improving core measure scores at the facility level.

Methods: The study facility is a 400 bed licensed tertiary referral hospital. It is part of a larger healthcare system, which is known for its clinical programs. A new process of accountability concerning the facility's core measure scores was implemented. This included holding a daily huddle with charge nurses and clinical pharmacists. The huddle is designed to provide education and updates concerning core measures. At the huddle, charge nurses report on the status of each patient, and whether their core measures have been met. The role of the clinical pharmacists is to validate that each measure has been satisfied. A facility-wide spreadsheet was developed for multidisciplinary use in the huddle. The clinical pharmacist on the floor reviews all core measures each day and updates the spreadsheet to ensure everything is accurate and complete. The expectation is that all care providers are accountable for 100% compliance with core measures.

Results: A multidisciplinary team that included clinical pharmacists and charge nurses improved core measures for our hospitalized patients. The facility's first-quarter and year-to-date figures (for the first 5 months of 2012, 2013, and 2014, respectively) showed an 84% reduction in Value-Based Purchasing failures. To track the hospital's progress, each unit is listed on a "Days of Clinical Excellence" slide on our electronic message boards. To date, the Cardiovascular ICU has the most consecutive days with zero defects, near-misses, or process breakdowns at 518 days.

Conclusion: Implementation of a daily multidisciplinary huddle focused on core measures was shown to consistently and dramatically reduce the number of core measure failures at a tertiary referral hospital and improve the hospital's performance on all medication-related core measure scores.

6-150

Category: Quality Assurance / Medication Safety

Title: Impact of an HIV Medication Therapy Checklist on Inpatient Antiretroviral Error Rates

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Purpose: Literature suggests that up to 72% of HIV patients admitted to the hospital experience at least one medication error. Interventions that have been shown to reduce medication error rates include education, the addition of computer alerts and safeguards, and medication profile review by a clinical pharmacist, often trained in infectious diseases. Investigators sought to assess the impact of an HIV medication therapy checklist in addition to the implementation of computer alerts and safeguards on the rate of medication errors in HIV-infected hospitalized patients.

Methods: This is a single-center, retrospective, comparative cohort study which included patients greater than 18 years of age admitted to the hospital receiving antiretroviral medications. To attain the study objective, a pharmacist-led HIV medication therapy checklist was developed and implemented in addition to computer alerts and safeguards. To assess the impact of the interventions, a retrospective review was performed before and after the intervention. Data collection for each patient included pertinent laboratory results, medication regimens, medication administration times, major interacting medications, and a calculated creatinine clearance based on Cockroft-Gault equation. Antiretroviral medication errors were categorized by type and frequency.

Results: A total of 259 patient admissions were included in the study (126 pre- and 133 post-intervention). 89/126 (70.6%) vs. 10/133 (7.5%) admissions contained at least one medication error and 42/126 (33.3 %) vs. 0/133 (0%) experienced 2 or more errors in the pre vs. post-intervention groups, respectively. Significant reduction persisted within each individual error type including wrong medication regimen [16/126 (12.7%) vs. 0/133 (0%); $p<0.001$], incorrect renal dose adjustment [7/126 (5.6%) vs. 0/133 (0%); $p=0.006$], missing medication [19/126 (15.1%) vs. 0/133 (0%); $p<0.001$], incorrect administration [55/126 (43.7%) vs. 4/133 (3.0%); $p<0.001$], and the presence of a major drug interaction [42/126 (33.3%) vs. 6/133 (4.5%); $p<0.001$].

Conclusion: Implementation of an HIV medication therapy checklist in addition to computer alerts and safeguards provided a significant reduction in medication error rates.

6-151

Category: Quality Assurance / Medication Safety

Title: Development and implementation of a student driven patient education program to improve Hospital Consumer Assessment of Healthcare Providers and Systems medication scores

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Purpose: Hospital Consumer Assessment of Healthcare Providers and Systems scores have become an important indicator of a hospitals perceived care and value to the community. Additionally, starting in 2016, 25 percent of hospital reimbursement rates from the Center for Medicare/Medicaid Services will be tied to that hospitals Hospital Consumer Assessment of Healthcare Providers and Systems score. Medication based questions were identified as an area where improvement was needed, the pharmacy was enlisted to help improve medication based scores. Our program was designed to leverage the pharmacy department and provide a solution without adding additional staff to our current staffing model.

Methods: The local college of pharmacy was approached to add an elective advanced pharmacy practice experience module on patient counseling. Once the elective module was approved, students created education material centered on the core measure disease states, heart failure, pneumonia, chronic obstructive pulmonary disease, acute myocardial infarction, and hip and knee replacement. The primary focus of the program was education on medications, their indications and side effects. A competency was created to ensure that the student involved in the education was trained in the primary medications addressed as well as in pharmacys computer functionality including access to pertinent patient information including labs and past medications. Lastly, each student spent at least 4 hours with the pharmacy director discussing methods of communication, purpose of program, and expected outcomes. The student was then observed interacting with patients by a pharmacist and coached to a mutual comfort point. The student was then expected to perform discharge education to the patient groups cited as well as round on all patients on the Medical Surgical floor, orthopedic floor and intensive care unit answering medication related questions during down times. Documentation of patient encounters, number of questions, times spent per patient and follow-up calls were kept.

Results: Six students have completed the six week elective rotation. All six students completed the training and competencies. A total of three hundred and thirty two discharge counseling encounters occurred averaging 14.96 minutes each. One hundred and twenty seven follow-up calls were made and forty nine patients were discharged to other institutions. In addition, two thousand fifty five student/ patient encounters occurred. Of these, eight hundred and seventy nine involved patient medication questions to the pharmacy student. Hospital Consumer Assessment of Healthcare Providers and Systems scores improved for both medication related categories.

Staff explanation of medications increased from 60.36 percent for the hospitals fiscal year 2014 to 64.91 percent for the first 8 months of hospital fiscal year 2015. Clear understanding of purpose of each medication increased from 67.86 percent for the hospitals fiscal year 2014 to 71.29 percent for the first 8 months of hospital fiscal year 2015. All six students felt that the rotation was very beneficial to them from a patient communication standpoint. The Director of Pharmacy feels the program benefits patients and improves pharmacy / administration relations, and will eventually help the hospital financially.

Conclusion: The program has been deemed successful by pharmacy, hospital administration and the students involved. There was a marked increase in our Hospital Consumer Assessment of Healthcare Providers and Systems scores indicating improvement in patient satisfaction. The program is ongoing.

6-152

Category: Quality Assurance / Medication Safety

Title: Development and implementation of a computerized drug-disease interaction program to improve patient safety

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Purpose: Adverse drug reactions are one of the leading causes of morbidity and mortality in healthcare. Due to the lack of an automated drug-disease interaction detection program, pharmacists are expected to prevent interactions through an inefficient retrospective process. A prospective safety mechanism is urgently needed to prevent serious drug-disease interactions from reaching patients. The purpose of this project was to create an automated alert within Cerner PowerChart to proactively notify providers of serious drug-disease interactions in order to significantly improve efficiency and patient safety.

Methods: Glucose-6-phosphate dehydrogenase (G6PD) deficiency was selected to pilot the program due to its potential for severe and life-threatening reactions with specific medications. A thorough literature search was conducted to compile a list of drugs that are potentially unsafe in G6PD patients, distinguishing between low and moderate-to-high risk for developing hemolytic anemia. A program was designed with an automated warning statement, triggered by ordering an interacting drug, to notify the clinician and prevent a potentially severe reaction. Problems and Diagnosis were selected as the locations where the rule identifies G6PD deficiency. Although Diagnosis is encounter specific, pertinent chronic diagnoses should be carried over to the Problems list which transcends encounters. Clinical Information Systems constructed the rules to direct the system to look for interactions between Problems and Diagnosis against a pre-determined list of drugs.

Results: Our electronic medical record system has been upgraded with a new proactive drug-disease interaction program that detects and alerts a clinician when an interacting medication is ordered on a patient with a documented G6PD deficiency in Problems and/or Diagnosis. The alerts display one of two different warning statements depending on the level of risk associated with a particular medication. Low-risk medications ask the clinician to weigh the risks versus benefits while high-risk medications tell clinicians to consider an alternative treatment. Both warning boxes allow for a simple method to cancel the order. A report was generated of all G6PD patients admitted to AtlantiCare Regional Medical Center within the last five years. Pharmacists updated the Problems list in these patients to include G6PD deficiency, protecting them from potentially fatal interactions for future admissions. This novel program will be

expanded to capture other significant drug-disease interactions in patients with disease states such as myasthenia gravis and porphyria.

Conclusion: The implementation of a computerized drug-disease interaction program will improve patient safety and workflow efficiency by proactively preventing potentially problematic orders from being placed.

6-153

Category: Quality Assurance / Medication Safety

Title: Characteristics of patients experiencing hypoglycemia in a community medical center

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Purpose: Adverse drug events related to hypoglycemia were identified as a target for quality improvement as part of the Hospital Engagement Network (HEN) partnership with the Centers for Medicare and Medicaid Services. Significant progress has been made in decreasing hypoglycemia related to medications at a community medical center participating in a HEN from a high rate 0.67% in October 2012 to months as low as 0% by the end of 2013. The purpose of this study is to determine the characteristics of patients experiencing a blood glucose <50mg/dL to facilitate hypoglycemia improvement.

Methods: Nursing staff received education on hypoglycemia and the institution's hypoglycemia protocol was revised to treat patients more aggressively in early 2013. To monitor improvement, all blood glucose results <50mg/dL according to point of care testing and lab draws in hospitalized adult, non-pregnant patients from January 2013 to April 2014 at a 212 bed community medical center were concurrently reviewed. The cause of hypoglycemia, renal function, nutrition status, and time of day of event were determined. This study was determined to be exempt from full review by the institutional review board.

Results: Six hundred and sixty-one values were identified <50mg/dL; 396 (n=227 unique patient encounters) occurred in patients receiving insulin or other oral diabetic agent, 210 occurred in patients receiving no antihyperglycemic, and 55 were determined to be collection errors. The median age of patients experiencing hypoglycemia when attributed to insulin or an antidiabetic medication was 60; with a mean blood glucose result of 41mg/dL. The low blood glucose events were attributed to the following agents: 35% basal insulin, 31% sliding scale insulin, 10% meal insulin, 8% onetime insulin orders (e.g. hyperkalemia), 6% oral antihyperglycemic agent, 5% mixed insulin, 3% insulin pump, and 2% insulin drip. One hundred and twenty patients (53%) received multiple agents. Of those experiencing a hypoglycemic event related to a medication, 56% had kidney dysfunction; 14% (n=32) had acute kidney injury and 42% (n=96) had chronic kidney disease. Although meal intake is not consistently documented, 31% with an event had orders for no oral intake or were eating <50% of meals. Events occurred most commonly during 0400-0700 (32%).

Conclusion: During the review period, a strong association with renal dysfunction was found in patients experiencing adverse drug reactions involving antihyperglycemics. While the breakdown of agents causing hypoglycemia was as predicted, the incidence of hypoglycemia

occurring in the absence of any agent being given was higher than anticipated. The results of this study will further help to improve safety by helping to target patients at risk for adverse drug reactions.

6-154

Category: Quality Assurance / Medication Safety

Title: Nursing perception of pharmacy bedside medication delivery servicing trauma, general surgery and abdominal transplant patients upon discharge

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Purpose: Discharge medication bedside delivery has been provided for 7 years at our tertiary medical center; however multiple barriers have prevented this process from being promoted by the nursing staff. In an effort to ensure patients have medications in-hand at time of discharge, we recently reviewed this process to eliminate barriers, decrease turn-around time in the delivery process and improve the patient experience at time of discharge. Nursing buy-in is a key component to the success of the program. We set out to gain a better understanding of nursing perception of the current process with a 14 question survey.

Methods: We created a 14 question survey to assess nursing perception of medication bedside delivery. All nurses on the surgical trauma and surgical transplant floors were asked to complete the survey. The survey was designed to assess nursing perception of the current bedside medication delivery process in an effort to identify barriers to the process and improve process efficiencies. Nurses were asked how long they had been a nurse, how long they had been a nurse at our hospital, and their involvement in the discharge process. They were asked how long it typically took from the time of discharge orders to the time of medication delivery from the outpatient pharmacy. Furthermore, we asked for their opinions about whom should be providing medication discharge counseling, whether or not they recommended the service, and their frustrations with the current process.

Results: Seventy five surveys were distributed and 52 responses (70%) were collected. The majority of nurses had been a nurse > 3 years (n=37, 71%) at our institution. The nurses perceived that discharge medications arrived on the hospital wards > 120 minutes (n=20, 38%) from the time discharge orders were placed, which also coincided with the time it takes for the patient to exit the hospital. Most nurses reported spending 5-15 minutes counseling patients on discharge medications (n=38, 73%) and reported that pharmacists are only sometimes (n=39, 75%) involved in the discharge process. Nurses stated pharmacists (n=18, 34.6%), physicians (n=16, 30.8%) and mid-level providers (n=11, 21.2%), should be the primary providers of medication counseling. Only 5.8% (n=3) believed that nurses should be the primary provider of

medication counseling. Overall perceptions of the medication delivery service were positive in 15.4% of respondents. Forty-two (80.7%) respondents also noted that the discharge medication service is refused at least once per week. A majority of nurses reported that the time it takes patients to obtain their medications was the major obstacle in the current medication discharge and delivery process.

Conclusion: Survey results show that a change in the discharge delivery process is warranted. A variety of logistical complications have made the timeliness of the service a frustration for nursing staff and patients. We are currently streamlining the process by hiring a decentralized pharmacy technician to oversee discharge medication delivery. Imperative to this process is support from nurses, as they will be the frontline staff to promote the service. Their feedback has helped develop this process to ensure patients have timely delivery of medications at discharge. Perceptions of the new process, including pharmacist involvement in discharge counseling, will be evaluated post-implementation.

6-155

Category: Quality Assurance / Medication Safety

Title: Evaluation of nursing comprehension on high alert medications following pharmacy education

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Purpose: High-alert medications possess the risk of causing significant patient harm when utilized incorrectly. They were first identified by the Institute for Safe Medication Practices through a study conducted across many institutions. The Joint Commission mandates that each hospital develop a high-alert medication list and establish processes to manage these agents. Adherence by nursing staff to policies and procedures pertaining to high-alert medications is imperative for safe medication practices. The purpose of this study is to evaluate the effectiveness of a pharmacy driven educational in-service to the nursing staff and assess their knowledge regarding the use of high-alert medications.

Methods: This was a single center, prospective, non randomized, interventional study conducted on all nursing units from January 2015 to April 2015. Upon review of our institutions high-alert policies and procedures, the pharmacy resident developed and distributed a pre-assessment at various nursing staff meetings. Pre-assessments were graded and a data collection sheet was used to document the results and identify knowledge gaps. The resident then designed an in-service and conducted presentations throughout the hospital. A post assessment was generated and distributed via email two weeks after the in-services to assess comprehension and retention of information. All questions were multiple choices and the maximum score on the test was 100 percent. Average scores were calculated and statistical significance was established by comparing pre- and post-assessment scores utilizing the Students t test. Average scores per question were also calculated and compared to determine specific areas of knowledge deficit in the information presented.

Results: Seventy-three nurses completed the pre-assessment survey and achieved an average score of 66 percent. Fifty-four nurses completed the post-assessment and an improvement was seen to an average score to 85 percent (p value less than 0.001). While improvement was noted overall, assessment scores remained relatively unchanged in the certain areas despite education. These areas included documentation of independent double check prior to administration and understanding of the high-alert lists applicability and customizability per nursing unit. Long term sustainability of comprehension of the information presented could not be assessed due time constraints.

Conclusion: A pharmacist driven nursing in-service resulted in greater understanding of policies and procedures pertaining to high-alert medications. In light of this study, decentralized pharmacists will incorporate this into their routine educational sessions. Additionally, these results will be shared with Staff Development to focus on areas still requiring improvement for the Annual Nursing Competency.

6-156

Category: Toxicology

Title: Survival predictors: what makes a difference in paraquat poisoning?

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Purpose: Paraquat in Taiwan is an inexpensive and effective herbicide that takes second place in sales. However, exposure to large doses of paraquat often results in a high mortality rate. Patients with paraquat poisoning may be asymptomatic or vomiting , mouth and throat ulceration, toxic myocarditis, pulmonary fibrosis, and multiple organ failure within hours or days. Despite paraquat levels in vivo are the most possible prognosis factor in paraquat poisoning, other survival predictors may be useful including age, renal, hepatic, and respiratory functions. Our purpose of this study was to determine the survival predictors after paraquat poisoning.

Methods: We reviewed 16 patients of oral paraquat poisoning between 2009 and May 2015. All urine samples from patients were tested positive by the dithionite reaction. Clinical parameters including age, arterial oxygen tension, serum creatinine, aspartate aminotransferase , alanine transaminase ,potassium, and urine or serum levels of paraquat were checked on admission to the emergency room. All patients were treated with pulse therapy (methylprednisolone 1g daily and cyclophosphamide 1g daily). All deaths (n=11) or survivals (n=5, only 4 patients were followed up after 2 months to detect delayed deaths) were recorded. Patients were divided into two groups based on quantitative measurement sample. We retrospectively measured serum paraquat concentrations in 10 patients and urine paraquat concentrations in 8 patients. Limited to a small sample size, Mann-Whitney U tests were applied to assess the predictors of survival after paraquat poisoning.

Results: In the serum group, the mortality rate was 70 % (7 out of 10). Mean fatal serum paraquat levels were 91.0 +/- 137.9 ug/ml versus 0.2 +/- 0.2 ug/ml mean survived serum paraquat levels ($p = 0.033$). There were no differences in survival with age ($p = 0.267$), arterial oxygen tensions ($p = 0.667$), serum creatinine ($p = 0.117$), aspartate aminotransferase ($p = 0.381$), alanine transaminase ($p = 1.000$), and potassium ($p=0.067$). In the urine group, the mortality rate was 75 % (6 out of 8). Mean fatal urine paraquat levels were 560.0 +/- 1001.1 ug/ml versus 48.5 +/- 25.1 ug/ml mean survived urine paraquat levels ($p = 0.643$). There were no differences in survival with age ($p = 1.000$), arterial oxygen tensions ($p = 1.000$), serum creatinine ($p = 0.071$), aspartate aminotransferase ($p = 0.143$), alanine transaminase ($p = 0.643$), and potassium ($p=0.071$).

Conclusion: There were no significant differences in survival with age, arterial oxygen tension, serum creatinine, aspartate aminotransferase, alanine transaminase, and urine levels of paraquat. Our results showed that serum levels of paraquat are the dominant survival predictor after paraquat poisoning; The high levels lead higher mortality rate. Only patients with low serum levels of paraquat<0.5 ug/ml survived, maybe those patients would survive even without the pulse therapy. The pulse therapy may be employed as a salvage therapy in paraquat poisoning since mortality rate of paraquat poisoning is high and current treatments are controversial.

6-157

Category: Toxicology

Title: Involvement of D-dopachrome tautomerase in acetaminophen-induced liver damage

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Purpose: Acetaminophen (APAP) is an analgesic and antipyretic drug used widely for the treatment of acute and chronic pains. It is known that APAP may induce dose-dependent liver damage in end-stage cancer patients treated with the high dose. Moreover, a few studies reported that the expression of D-dopachrome tautomerase (DDT) was detected extremely higher in the liver than the other organs, and that liver damage by hepatitis B virus infection, partial hepatectomy and so on induced the expression of DDT. In the present study, we investigated the effects of drug-related liver damage caused by APAP on the DDT expression.

Methods: Human liver carcinoma cells, HepG2 was cultured under conditions of 37, 5% CO2 in the culture medium with 10% of fetal bovine serum and various antibiotics. To induce drug-related liver damage in the HepG2 cells, APAP at various concentrations was added into the cell culture medium and exposed to the cells for 24 h. The cytotoxic evaluation was performed by using the water-soluble tetrazolium salt (WST-1) assay and trypan blue exclusion test. Intracellular and extracellular DDT proteins in the cells were quantitatively determined by Western blotting according to the method reported previously. Differences in the expression of DDT among the cells exposed to various concentrations of APAP were analyzed using the one-way ANOVA followed by the Dunnettfs test. Statistical significance was set at $p<0.05$.

Results: In order to evaluate the cytotoxicity of APAP, we determined the viability of the cells treated with 1 to 50 mM of APAP. As the result, APAP significantly decreased the cell viability at the concentration of more than 20 mM, indicating a concentration-dependent hepatotoxicity of APAP. In addition, the amounts of the extracellular DDT protein in APAP-treated cells at the concentration of more than 25 mM were significantly induced to 3-folds of the non-treated cells. In contrast, the expression of the intracellular DDT protein was significantly decreased to 10% of the intact cells by the exposure to APAP at the concentration of more than 25 mM. At the lower concentrations of APAP, however, the intracellular DDT protein was significantly induced to 150% of the non-treated cells. Therefore, it is suggested that intracellular DDT levels can sensitively increase even in the cells slightly damaged by the low concentration of APAP, while the exposure to the high concentration of APAP could reduce the cell viability, subsequently increased the extracellular levels and decreased the intracellular levels presumably by a leak out of the cells.

Conclusion: It was found that intracellular DDT amounts were induced by the APAP concentration in which the cell viability was preserved. This may mean that DDT has a protective function against APAP-induced hepatic damage. Further additional examination is necessary to clarify the contribution of DDT in the process of liver damage caused by APAP.

6-158

Category: Toxicology

Title: Mental illness and medications found on post-mortem toxicology screens

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Purpose: Individuals diagnosed with mental illness are at higher risk for substance abuse than the general population. Drug abuse may precipitate mental illness and mental illness may lead to abuse. Individuals suffering from a mental illness may self-medicate as a way of coping or to lessen the effects of the illness or the effects of medications used to treat their disease. The purpose of this study was to identify individuals with a mental illness and evaluate medications found on toxicology screen, particularly those listed as the cause of death in autopsies recorded by the coroners office.

Methods: This study was determined exempt from IRB requirements due to the deceased status of the subjects involved. A retrospective review of data from the local coroners database of autopsies performed in 2011 and 2012 was performed. Data collected included each subjects age, gender, medical history (if known), post-mortem blood concentrations of both legal and illicit drugs (toxicology screens), as well as the coroners cause of death.

Results: 101 subjects (66 female and 35 male) were identified with a history of mental illness. Average age of subjects was 46.2 years; female average age 46.2 and males 46.2. Mental disorders found on patient histories included depression (63 percent), bipolar (24.8 percent), anxiety (47.5 percent), schizophrenia (4 percent), and other (23 percent). Average number of medications identified per subject on toxicology screen in patients with a mental illness was 6.1 (range 1-13); females 7.2 (range 2-13) and males 5.4 (range 1-11). Alcohol was identified in 32 percent of females and 26 percent of males. Illicit drugs were found in 9 and 23 percent of females and males. Sixty eight subjects were identified as having medications noted by the coroner to be the cause of death. Of these 68 patients, the average number of medications identified per subject on toxicology screen was 7. Of the subjects who had cause of death secondary to medications, opioids were found in 46 percent, benzodiazepines in 44 percent, SSRIs in 28 percent, methadone in 24 percent, alcohol in 16 percent, TCAs in 12 percent, diphenhydramine in 9 percent, and illicit substances in 8 percent of subjects.

Conclusion: Of 182 autopsies with medications found on toxicology screen, 101 were subjects with mental disorders. A greater number of females were identified to have a mental illness history. Opioids, benzodiazepines, SSRIs, methadone, diphenhydramine, alcohol and illicit substances were most commonly identified. Healthcare providers need to be aware of the increasing use of medications, alcohol and illicit substance abuse in individuals with mental disorders. Limiting prescribing, educating and reducing access to these substances may reduce the comorbidity between substance abuse and mental disorders. Pharmacists are on the front line to identify and evaluate patients at risk for abuse.

6-159

Category: Transplant / Immunology

Title: Burden of neutropenia-related hospital readmissions among hematopoietic cell transplant recipients

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Purpose: Neutropenia is common after hematopoietic cell transplantation (HCT) and is a consequence of conditioning chemotherapy and concomitant medications. Neutropenia increases the risk of opportunistic infections and other complications, and has been associated with increased mortality. The purpose of this study was to examine the occurrence of neutropenia-associated hospital readmissions among HCT recipients, as well as associated costs from a hospital perspective.

Methods: We identified patients who received an HCT between January 2009 and September 2013 from hospital discharge claims based on ICD-9 codes in the Premier Hospital database. The first HCT procedure was defined as the index event. Demographics and clinical characteristics were evaluated, as well as the frequency of hospital readmission associated with neutropenia during a 12-month period following the index HCT hospitalization. Additionally, total hospital costs of neutropenia-related hospital readmissions were assessed specifically for prescriptions, room and board, laboratory tests, blood bank services, diagnostic imaging services, and chemotherapy and radiation treatment services.

Results: The HCT recipient cohort (n=4,393; mean age: 50.4 years) were 58% male, and 9% were <18 years of age. Most patients received HCT in urban (94%), large (600 beds: 66%), teaching hospitals (88%). During index HCT hospitalizations 157 deaths occurred, resulting in an evaluable population of 4,236 patients. Among this study population, 10% (n=422) had a hospital readmission for neutropenia during the 12 months after discharge of the index HCT hospitalization, with 24% occurring within 1 month and 53% occurring within the first 3 months. Among patients who had an allogeneic (allo)-HCT and those who had an autologous (auto)-HCT 15% and 7% had a neutropenia-related hospital readmission, respectively. The mean length of hospital stay for patients who had a neutropenia-related hospital readmission during the follow-up period was 22 days (standard deviation (SD): 23 days; median: 15 days), with those who had an allo-HCT having a significantly longer stay than patients who had an auto-HCT (26 vs. 17 days, respectively, $p<0.001$). Total mean hospitalization costs among patients with neutropenia-related readmissions were $83,624, with those who had an allo-HCT having a significantly higher mean hospital readmission cost compared with patients who had an auto-HCT ($107,827 vs. $56,244, respectively, $p<0.001$).

Conclusion: One in ten HCT recipients experienced a neutropenia-related hospital readmission, with about half occurring in the first three months after discharge of the index HCT hospitalization. Neutropenia-related hospital readmissions are costly and can present challenges in the clinical management of HCT recipients.

6-160

Category: Women's Health

Title: Evaluation of gastrointestinal complications in Lebanese pregnant females

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Purpose: Most pregnant women experience gastrointestinal (GI) disorders such as nausea, vomiting, or heartburn, which are motility disturbances, explained by altered hormone levels. While those symptoms are usually mild to moderate and respond to simple therapeutic measures such as lifestyle and dietary changes, some women suffer severe ones and need medical therapy. Studies to evaluate the perception of the Lebanese females about those disorders are missing. The aim of this study is to evaluate the knowledge, awareness, and treatment of females about the GI complications that they might have encountered during gestation in Lebanon.

Methods: The institutional review board at the Lebanese International University approved this community based retrospective multicenter observational study which was conducted between November 2014 and June 2015. A clinical data collection form was developed and filled for Lebanese females who met the inclusion criteria of having experienced at least 1 pregnancy during their lifetime. The pharmD candidates obtained an oral informed consent before gathering data to fill 20 variables about the participants' demographics, income, and past medical history. Information regarding nausea, vomiting and heartburn included history, frequency, and severity of the episodes, along with the nonpharmacologic and pharmacologic treatment taken. The females were also asked whether complete relief was achieved with any of the measures undertaken. All statistical analysis was performed using SPSS version 20.0 and presented as frequency, percentage, means, and standard deviations (SD).

Results: The data was investigated on 381 predominantly white, upper middle class women with an average age of 29.23 years (SD 6.137). The past medical history included irritable bowel syndrome, peptic ulcer, and gastroesophageal reflux disease in 6.3, 7.1, and 5.8 percent. The incidence of nausea and vomiting was about 76.1%, of whom 53.8% had everyday symptoms (peak in first trimester) and 72.3% had moderate to severe ones. Nonpharmacologic measures consisted of using ginger, citrus fluids and peppermint in about 15%. Patients, who were not relieved, sought medical therapy which included pyridoxine and meclozine, metoclopramide, domperidone, dimenhydrinate, ginger tablets, and ondansetron in 35.1, 15.5, 6.2, 3.4, 1.4, and 1.4 percent respectively. As for heartburn, it was reported in 71.1% (peak in second trimester) and 73.7% sought medical interventions to relieve it. Lifestyle changes to alleviate reflux included avoiding spicy food (27%), meals before sleep (17.4%), and caffeinated or carbonated beverages (17%). Interestingly, relief was also attained by eating cucumbers in 13%. When those

changes werent sufficient, 35.6% were prescribed antacids, 17.4% histamine 2 receptor antagonists, and 14.4% proton pump inhibitors (pregnancy category C: omeprazole 51.3%, rabeprazole 17.9%, and esomeprazole 12.8%; pregnancy category B: pantoprazole 15.4% and lansoprazole 2.6%).

Conclusion: Nausea, vomiting and heartburn are bothersome symptoms affecting a pregnant womens quality of life. It is important to consider the risks and benefits of nonpharmacologic and drug therapy to both mother and fetus. Our data show that the management is not very well understood and haphazard in terms of adequacy and safety. This should urge prenatal care providers and pharmacists to cooperate in creating more awareness regarding the decision to treat GI complications in pregnancy based on the safety profile of the drugs in question, symptom severity, and potential for quality of life improvement.

6-161

Category: Women's Health

Title: Survey of pharmacist and pharmacy student knowledge regarding oral emergency contraception in ambulatory care practice at an academic medical center

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Purpose: In the United States two types of oral emergency contraception (EC) are available: levonorgestrel (LNG) and ulipristal acetate (UPA). EC access continues to evolve; in 2013 LNG 150 mg became available OTC without age restrictions. However, LNG 0.75 mg x 2 dose formulation remains behind the counter with age restrictions. UPA became available in 2010 and is prescription only. Since then conflicting efficacy data has been published regarding oral EC agents in obese patients. These complex and rapidly changing provision regulations, in conjunction with conflicting efficacy data, may lead to false barriers or misinformation for patients seeking oral EC.

Methods: The objective of this study was to evaluate the knowledge and comfort of pharmacy personnel regarding provision, counseling, and patient questions regarding EC. Participants for this survey included pharmacists and pharmacy students working at the UIC Hospital and Health Sciences System outpatient pharmacies or ambulatory care clinics. A questionnaire was given to subjects prior to a one hour CE program that was led by the study investigators. Primary endpoints collected by the survey evaluated if pharmacy personnel 1) understand that oral EC is safe and well tolerated, 2) know the similarities and differences between LNG EC and UPA EC, 3) are aware that LNG EC may have decreased efficacy in women weighing greater than 165 lbs, and 4) understand current regulations surrounding oral EC provision requirements. Descriptive statistics were performed with Excel software.

Results: A total of 30 pharmacists and 9 pharmacy students from UIC community pharmacy or ambulatory care clinics responded to the survey. Of those surveyed, 51% had counseled or dispensed LNG EC within the past 6 months, compared to 13% with UPA EC. Sixty seven percent indicated they were somewhat comfortable or very comfortable counseling for LNG EC verses 38% for UPA EC. Regarding potential side effects, 59% falsely believed that greater than 50% of women who take LNG EC vomit. However, 85% correctly identified that LNG EC efficacy declines on day 4 and 5 after intercourse, and 67% identified that LNG EC is less effective in women who weigh greater than 165 lbs. Among pharmacists and pharmacy students, only 46% correctly identified LNG 1.5 mcg EC as over the counter status, and 56% correctly indicated there is no associated age restriction for LNG EC purchase. Regarding UPA EC, 67% of pharmacists and pharmacy technicians correctly identified it is only available as a prescription.

Conclusion: Gaps in pharmacy personnel knowledge may lead to patient misinformation or decreased provision of timely EC. LNG 1.5 mcg EC is now available OTC, however most survey participants identified it as a behind the counter product, which may hinder patient access. UPA is more effective than LNG EC on days 4-5 following intercourse and in women 165 lbs or greater; however, many are not comfortable counseling patients regarding this product, and the vast majority has never dispensed this medication. Increased professional education may improve knowledge and comfort in provision of this important medication, and ultimately benefit patients seeking EC.

6-162

Category: Administrative practice / Financial Management / Human Resources

Title: Impact of implementing a once daily automated dispensing machine refill on workflow and stock out rates.

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Purpose: Automated dispensing machines (ADMs) assist in providing medications to patients in a safe and timely manner. However, in order to keep the ADMs adequately stocked often requires extensive work on the pharmacy and coordination with the standard administration time. The purpose of this study is to determine if changing to a once daily refill process for all ADMs has an impact on the workflow or medication stock out percentages.

Methods: The baseline data is measured from May 2013-October 2013. During the baseline period the frequency of refilling ADMs varied from two times a day to five times a day. To accomplish once daily refills, the inventory of the ADMs were reviewed and adjusted based on vend/refill ratios of 10-12 and medication dispensing reports. The minimum and maximum levels were set to a 10 day maximum and a 4 day minimum. The follow-up period is from November 2013-May 2014. Implementation was complete by October 31, 2013 and in November 2013, refills were changed to once daily. Data collected included full-time equivalents in applicable job assignments, stock out percentages, and the vend/refill ratio. Continuous data was analyzed using a students t-test. All statistical analysis was performed using Graphpad.

Results: The actual vend/refill ratio was 7.017 in the baseline period and 8.850 in the follow-up period. In May 2013 there were a total of 18.95 full-time equivalents/week assigned to jobs that interacted with the ADM refill process. By transitioning to a once daily refill system, this number decreased to 13.8 full-time equivalents/week. The average stock out percentage in the baseline data was 0.833, and this was decreased to 0.567 in the follow-up period ($p=0.0002$). Although barcode scanning compliance was not assessed it was noted that it increased from 92.16% to 96.3% over the time period.

Conclusion: This study concludes that by transitioning to a once daily refill process by increasing vend to refill ratios for ADMs, full-time equivalents involved in the ADM refill process decreased and stock out percentages decreased. Although this study was not designed to assess barcode scanning compliance, there was an increase in the rate of compliance noted. Further study is required to ensure these results are maintained in the long-term.

6-163

Category: Ambulatory Care

Title: Assessment of Lebanese adult population awareness about hepatitis B vaccine

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Purpose: Hepatitis B is caused by hepatitis B virus that is mainly transmitted by percutaneous and permucosal exposure to infected body fluids. According to Epidemiology Surveillance Unit of the Lebanese Ministry of Public Health in 2014, total of 218 cases of hepatitis B were reported with a minimum of 82% among individuals above 20 years. The objective of this study is to assess the level of awareness to hepatitis B vaccination among Lebanese adult population and evaluate the impact of the clinical pharmacist to raise awareness.

Methods: A prospective observational study was conducted from December 2014 till May 2015 over different regions in Lebanon and participants were randomly selected. The study was approved by the Institutional Review Board of the Lebanese International University and a written informed consent has been signed before enrollment into the study. The inclusion criteria included adult Lebanese individuals. The exclusion criteria included children, cancer, or neurological deficit patients. Data collection sheet included questionnaire about individuals demographics, past or present medical history, knowledge about hepatitis B vaccine, and factors that influenced the vaccine administration. Individuals knowledge about hepatitis B and adults at risk was assessed by the pharmacist before and after counseling, the second assessment was done 12 weeks from the first assessment. The primary outcome measure was to assess the level of awareness among Lebanese adult individuals about hepatitis B vaccine. Secondary outcomes were to assess the role of pharmacist in increasing awareness, and evaluate the compliance with international recommendations whenever indicated. SPSS software version 21.0 was used to analyze the study results. Paired sample t-test was used to explore the statistical differences between variables. A P-value <0.05 considered to be statistical significance.

Results: From a total of 270 subjects who were enrolled in this study, 78 (29%) individuals know the availability of hepatitis B vaccine initially. It is important to note that out of these individuals, 71 (91%) were in the health care field. From the individuals who know previously about the vaccine, only 25 (32%) took the vaccine, and the primary reason was recommendation by health care professional. Before counseling, 68(25%) were able to state high risk profile adults for hepatitis B and thus need the vaccine, versus 237 (88%) post counseling. Moreover, from those who became aware of hepatitis B after counseling, 49 (21%) are now willing to undergo the vaccination process and adhere to the international recommendations. A p-value

<0.001 represented the level of significance between patients knowledge and their willingness to do the vaccine before and after counseling.

Conclusion: Based on the study findings, Lebanese adults lack the awareness about hepatitis B and hepatitis B vaccine, and the knowledge is mainly limited to healthcare personnel. This study highlights the role of pharmacist counseling to enhance the awareness and adherence to the vaccination program. Further studies on a larger scale population are required to raise the awareness about hepatitis B vaccine, and limit the disease prevalence.

6-164

Category: Chronic / Managed Care

Title: Evaluation of the management of hyperphosphatemia in patients with ESRD on hemodialysis in Lebanese hemodialysis centers

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Purpose: Serum phosphate, calcium, and PTH (parathyroid hormone) concentrations are all inter-related in patients with chronic kidney disease. One of the major complications of End Stage Renal Disease (ESRD) is hyperphosphatemia. Dietary phosphate restriction along with phosphate binders (calcium and non-calcium containing binders), increased and/or extended hemodialysis, and calcimimetics are recommended to treat this complication. Concomitant vitamin D supplementation is often required to improve hyperphosphatemia management. The objective of this study is to evaluate the management of hyperphosphatemia among patients with ESRD in Lebanese hemodialysis centers according to the Kidney Disease: Improving Global Outcomes (KDIGO) guideline.

Methods: The Institutional Review Board of the Lebanese International University approved this prospective, multicenter, observational study that was conducted from October 2014 to April 2015. All ESRD patients on hemodialysis were enrolled in this study. Cancer patients and patients under the age of 18 were excluded from the study. Phosphorous levels were evaluated on monthly basis from October 2014 till April 2015. Hyperphosphatemia was defined as phosphorous levels greater than 5.5mg/dl with a target level of 3.5-5.5 where the management of hyperphosphatemia was evaluated according to KDIGO guidelines on monthly basis and divided to either acceptable treatment or not acceptable treatment defined as wrong drugs or wrong doses. Hyperphosphatemia treatment includes calcium containing binders (calcium carbonate and calcium acetate) , non-calcium containing binders (sevelamer and lanthanum), vitamin D supplementation, cinacalcet. The statistical analysis was done by SPSS.

Results: 282 hemodialysis patients were screened: 250 patients met the inclusion criteria with 54.8 percent males and 45.2 percent females. Mean age was 59.4. 14 patients were excluded of which 12 were cancer patients and 2 patients were under 18 years of age. 18 patients left the study for different reasons: 2 patients traveled, 2 underwent renal transplantation, 1 patient stopped dialysis, and 13 left for unknown reason. Of the 250 patients, 169 patients (68.4 percent) had hyperphosphatemia. Among hyperphosphatemia patients, the management was acceptable with significance in October (p-value 0.01), November (p-value 0.033), January (p-value 0.028), February (p-value 0.008), March (p-value 0.004), and April (p-value 0.00) in which better decrease in phosphate levels was shown with patients taking the right acceptable treatment with

p-value less than 0.05 versus not acceptable treatment. However, there was no significance in December correlating acceptable management to phosphate decrease in levels and this maybe due to the limitation of holidays and excess food consumptions affecting phosphorous levels.

Conclusion: According to our study, there was statistical difference for acceptable management and reduction in phosphate levels. Thus, phosphate monitoring constitutes a cornerstone in the acceptable management of hyperphosphatemia favoring the decrease in phosphorous level versus not acceptable management.

6-165

Category: Drug-Use Evaluation

Title: Evaluation of the use of phosphodiesterase 5 (PDE5) inhibitors in the Lebanese community

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Purpose: PDE5 inhibitors are a relatively recent class of drug dedicated to the treatment of erectile dysfunction. These drugs have been widely used since their introduction in 1998. We aim to assess the use of PDE5 inhibitors in the Lebanese community and describe the profile of a PDE5 inhibitor user. This is following observations of a multitude of men who purchase these products regularly. This stresses the need for healthcare professionals to counsel men on the proper use of these products in order to ensure their safety and limit any abusive tendencies.

Methods: Research about the subject matter was done using the MEDLINE database. Keywords used included phosphodiesterase 5 inhibitors, administration, sildenafil, tadalafil, and vardenafil. A data collection questionnaire was formulated following the research. Data collection was done in several community pharmacy sites in different regions of the country by the researchers between 2014 and 2015. This was done using the survey form which contained questions pertaining to the topic proposed including the subjects' detailed sexual activity and usage of the agent. Subjects included in the study were males of all ages presenting to the community site in order to purchase PDE5 inhibitors for personal use. All agents of this class were included in the collection. Subjects were given the choice of either filling out the form personally or having it filled out by one of the researchers. This was done to ensure a maximum number of subjects owing to the taboo nature of the topic in Lebanon. Informed consent was obtained prior to each interview and validated with the subject's signature. The researchers took time to explain the aims of the study and answer any inquiries presented. The Institutional Review Board (IRB) approved the study prior to its start.

Results: In all 181 subjects were enrolled. The age of the subjects varied between 18 and 76 years with a mean of 39.8 years. The governing socio-economic status among the responders was that of middle class with 69.1 percent. When asked about their social history, 68 percent reported being smokers and 33.7 percent alcohol consumers. Regarding their sexual activity, 30.4 percent of subjects reported one sexual encounter per week. Concerning the agents used, 64.1 percent used sildenafil, 26 percent tadalafil and 9.9 percent vardenafil. The reasons for use varied from FDA approved indications to others. In fact, 25.4 percent of the subjects used the product for erectile dysfunction whereas 67.4 percent cited performance enhancement as their main reason. In addition, 72.9 percent of subjects reported experiencing side effects including headache,

flushing, tachycardia, and many others. Moreover, due to the relatively low mean age of the subjects, only 30.9 percent admitted to having concomitant diseases. Subjects included 18.9 percent hypertensive and 11.6 percent diabetics. It's worth noting that 74 percent of patients feel that society pressures them into hiding the agents' use. However, 93.9 percent confessed that they wouldn't mind receiving counseling on the use of the agents.

Conclusion: The results showed that there is a wide interpersonal variability among users of PDE5 inhibitors. This allowed the authors to play an active role in counseling the individuals on the correct use of these products. Moreover, a profile of the typical user of PDE5 inhibitors was drawn from the responses obtained. There may be a correlation between socio-economic status and use of the product which requires further investigation. The researchers observed that some subjects were using the agents for unconventional indications. Therefore, a study taking into consideration the abuse potential of these agents in the Lebanese community is suggested.

6-166

Category: Infectious Diseases

Title: Meningitis mortality rate at Lebanese hospitals

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Purpose: Meningitis is an infectious disease affecting the meninges; it is a medical emergency that require immediate interventions. Antibiotic therapy, and adjunctive dexamethasone when indicated, should be started immediately after taking cerebrospinal fluid and blood cultures. Therapy delay should be avoided because it increases mortality rate, and incidence of long term neurologic sequalae. Worldwide mortality from untreated meningitis cases is as high as 70 %. This study was conducted to assess mortality of meningitis between different age groups, and to study the association between incompatibilities with the Infectious Diseases Society of America (IDSA) guideline and mortality rate at Lebanese hospitals.

Methods: This was a retrospective study conducted in four Lebanese university hospitals after the approval of the Institutional Review Board. Patients admitted to hospitals with meningitis diagnosis from January 2008 till December 2014 was considered eligible for study enrollment. Immunocompromised patients, pregnant females, and long term steroid users were excluded. Patient demographics, past medical history, present active problems, vaccination history, signs and symptoms, microbiologic laboratory results, and cerebrospinal fluid results, initial empiric treatment, definitive therapy, mortality, and neurological complications were obtained from the medical records. Each patient was screened for mortality. The clinical outcome variables were mortality rate between different age groups, and association between overall compatibility and mortality rate. Chi square and logistic regressions were used appropriately to report the results using the two sided p-value with the alpha set at a significance of 0.05. Statistical analyses were performed using software package used for statistical analysis version 22.

Results: A total of 280 patients diagnosed with meningitis were screened for possible enrollment in the study. From these, 168 (60%) were diagnosed with viral meningitis and 112 (40%) with bacterial. There was a significant association between mortality rate and different age groups with a P value of 0.002 for viral and 0.003 for bacterial. In patients with bacterial meningitis, mortality rate of those aged less than 1 month was (16.7%), this percentage had increased to (27.3%) in patients aged from 1 month to 2 years, and to (32 %) in patients from 2 to 50 years, reaching its highest percentage (54.5%) in adults > 50 years of age. Whereas in patients with viral meningitis, mortality rate of those aged less than 1 month was (21.7%), this percentage had remained constant throughout the 2 consecutive age groups; (21.1%) in patients aged from 1 month to 2 years, and (22.5%) in patients from 2 to 50 years, reaching its highest percentage

(50%) in adults > 50 years of age. For the overall treatment compatibility with the IDSA guideline, the significant association was also documented for viral and bacterial meningitis with p values of 0.005 and 0.002 respectively.

Conclusion: Results of this study showed that inappropriate meningitis treatment, and increased age increases mortality rate significantly, so serious steps; such as awareness campaigns, should be taken to minimize medication errors, and monitor compatibility with the guideline. Meningitis is a life threatening condition, that could results in death even when treated appropriately, so preventive measures should be implemented, to protect our society from its outcomes; not only mortality, but also lifelong neurologic complications.

6-167

Category: General Clinical Practice

Title: Prevalence and risk factors for extended spectrum beta lactamase urinary tract infections in hospitalized adult patients in Lebanon

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Purpose: Enterobacteriacea are the most common causes of urinary tract infections (UTIs) in both community and health care settings. The extended spectrum beta lactamase (ESBL) producing bacteria are emerging species resistant to many available broad spectrum antibiotics, for which epidemiological studies in Lebanon are limited. The aim of this study is to determine the prevalence and risk factors of ESBL in patients with a UTI in Lebanese hospitals.

Methods: With the approval of the institutional review board of the involved institutions, a retrospective multicenter observational study was conducted between January 2014 and April 2015 in three Lebanese hospitals. A clinical data collection form was developed and filled from the medical charts of discharged inpatients who met the following inclusion criteria: admitted for or have developed a UTI, age more than 12 years old, and were in the internal medicine, critical care, or surgery units. The questionnaire included information about the patients' demographics, comorbidities, UTI history, culture sensitivity results, and potential risk factors associated with ESBL. All statistical analysis was performed using SPSS statistics version 20.0, whereby chi-square, t-test, and fisher exact test were used when applicable with a p-value of less than 0.05 being considered statistically significant. A multivariate analysis employing logistic regression was later performed with all significant variables.

Results: The survey data included 312 patients with a mean age of 63.2 years (SD 20.2). There were 94 (30.1%) males and 218 (69.9%) females who were admitted to different hospital units: internal medicine (68.4%), intensive care unit (20.3%), critical care unit (8.7%), and surgery (2.6%). The mean length of hospital stay was 11.5 days (SD 12.1), whereby the prevalence of ESBL was 42.9%. The most common isolates detected were Escherichia coli (73.5%) followed by Klebsiella pneumonia (14.2%) and Pseudomonas aeruginosa (4.9%). Escherichia coli was the dominant ESBL producing pathogen (86.4%). In those with ESBL, the antimicrobial resistance rates to ceftriaxone, ceftazidime, cefepime, and ciprofloxacin were 85.5%, 70.3%, 73.6% and 85.7%, respectively; whereas, the sensitivity rates to meropenem, ertapenem, imipenem, fosfomycin, nitrofurantoin, and trimethoprim sulfamethoxazole were 91%, 90.5%, 89.5%, 88.9%, 84.4%, and 33.9% respectively. There wasn't a significant association between ESBL infections according to gender and diabetes history (p-value more than 0.05). However, an increased risk of ESBL infections was detected in patients who had a history of UTI (OR=3.0,

P=0.05) or stroke (OR=4.168, P=0.02), and in those who received a previous corticosteroid therapy (OR=2.49, P=0.025) or a third generation cephalosporin in the past 3 months (OR=2.875, P=0.041).

Conclusion: The overall prevalence of ESBL producing microorganisms among patients with UTI was 42.9%. Factors that were found to be predictive for ESBL infections included a previous medical history of UTI or stroke, as well as, corticosteroid therapy and third generation cephalosporins in the past 3 months. The recognition of risk factors for ESBL positive UTI may help in identifying high risk cases and in establishing empirical antibiotic policies by clinical staff including pharmacists and infectious specialists, which would also prevent the spread of multidrug resistant microorganisms.

6-168

Category: Nutrition Support

Title: Evaluation of Bariatric surgery patients in Lebanese community

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Purpose: Worldwide, the number of patients undergoing bariatric surgeries is increasing, from 140 000 in 2003 to 340 000 in 2011. There are different types of bariatric surgeries ranging from purely restrictive surgeries like adjustable gastric banding (AGB) to mainly restrictive procedures like sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGB) to primarily malabsorptive surgeries like biliopancreatic diversion (BPD). In Lebanon, the trend is comparable to the world; bariatric surgeries are gaining a large popularity. The aim of this study is to evaluate: the patients demographics and history and the type of bariatric surgeries that are done in the Lebanese

Methods: A survey was developed and validated to evaluate the demographic data, health history and type of type procedure done. Inclusion criteria were: Patients more than 15 years of age that had done any type of bariatric surgeries from 2000 till 2014. Detailed demographics, medical history, medication history and lifestyle/diet habits have been identified and included in the survey. Pharmacy students within the clinical nutrition course were asked as part of their patient counseling project to fill this form with patients in the community that met the inclusion criteria. The survey is composed of thirty multiple choice questions and required an average of fifteen minutes to be filled. The study was approved by the institutional review board of the university; an oral informed consent was taken from the patients. Data was analyzed using Statistical Package for the Social Sciences.

Results: Survey data was analyzed based on 300 responses (34.3 percent male, 65.7 percent female). The age of respondents varied between 15 and 65 years old, where the majority, 198 patients were between 21 and 39 years. The participants were from all Lebanese regions with 49.7 percent of them being from the main city, Beirut. 57.7 percent of respondents had an average socio-economic status and 69 percent do not engage in regular physical activity. 168 participants are smokers: Water pipes and/or cigarettes and 258 are non-alcohol consumers. More than half of the patients, 173 underwent SG, 81 have done RYGB and 46 underwent AGB. 177 patients had a BMI of more than 40 before surgery and 191 used be on a non healthy diet. 46.7 percent of the respondents confirm having been counseled by the physician and only 2 percent by pharmacists about the procedure. 37.7 percent of the enrolled population confirm getting information about the surgery from a friend/family member that have done a bariatric surgery or by the internet. Concerning the medications: 45 patients are on antihypertensive

therapy, 30 on lipid lowering agents, and 34 on antidiabetics. 42.3 of the patients confirm starting iron supplements immediately after the surgery.

Conclusion: Based on the survey results, most participants underwent SG, thus following the world trend. But most patients needed counseling about the appropriate practices after surgeries, from lifestyle management to medications/nutrients adjustments. This project has served as a good opportunity for pharmacy students to raise public attention on bariatric surgeries. Awareness campaigns about the effects and the management of the drugs after these surgeries are crucial, because many drugs must have special consideration after bariatric procedures. This area of practice needs the input of a pharmacist to tailor the medications for the patients.

6-169

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Trends in the prevalence, awareness, treatment, control and risk factors associated with hypertension in Lebanese adults: A cross sectional study

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Purpose: The prevention and control of hypertension is an essential componentfor reducing the burden of cardiovascular diseases. Hypertension is an important public health issue in Lebanon, yet few studies have examined its current status among the Lebanese population. Despite use of antihypertensive medications, the extent of blood pressure control is not largely known. The objective of this study was to examine the prevalence, awareness, treatment and control of hypertension and its associated risk factors among Lebanese adults.

Methods: A prospective, cross-sectional study was conducted between December 2014 and May 2015 with non-pregnant adults from 5 districts of Lebanon: North, Beirut, Bekaa, South, and Mount Lebanon. Cluster sampling method was used to select the participants. The participants blood pressure, weight and height measurements were done by two registered pharmacists, and the participants were asked to complete a questionnaire to assess hypertension risk factors. Hypertension prevalence was defined as individuals with self-reported treated hypertension, or with an average of 2 blood pressure measurements of at least 140/90mmHg for those under 65 years or 150/90 mm Hg for those 65 years and above using an automated digital device. Awareness was defined as the participant being informed of having hypertension by a health care provider. Treatment was defined by regular use of one or more antihypertensive medications, and control was defined by the participant classified as having hypertension and the measured blood pressure beinglower than 140/90mmHg. Risk factor significance was analyzed using chi-square and logistic regression.

Results: Of 1362 Lebanese adults interviewed, 399(29.3 %) had hypertension. Of these, 106 (26.5 %) were aware of the condition,and 79 (20 %)were receiving treatment.Amongthe 106 aware participants, treatment rate was higher (74.5%).Forty-three (10.7%)participants from all hypertensives were controlled, but control was higher in those treated (54.4%).Prevalence was higher in males compared to females (38.8 % versus 20.1 %; $P< 0.05$), andincreasedwith smoking, with 59.3 % of hypertensive participants being smokers ($P =0.02$). The prevalence was 20.8 % in individuals aged 18-29 years and 62.5 % among those aged above 69 ($p < 0.05$). Awareness was highest in capital area of Beirut and lowest in rural area of Bekaa (34.4 % versus 5.7 %; $P= 0.04$). Blood pressure control was also highest in Beirut and lowest in Bekaa. Treatment waspredominant in those aged> 69 (68.4 %) and lowest for those between 18-29 years

(3 %; $P < 0.05$).Significant risk factors for hypertension were male gender, older age, smoking, family history of hypertension, overweight, obesity, comorbidities, and low educational level.However, family income, alcohol intake, health insurance and physical activity were not significant.

Conclusion: Hypertension is prevalent among the Lebanese adult population and is multifactorial, but remains incompletely recognized leading to insufficient control. Given relative ease of detection of hypertension and availability of various antihypertensive therapyoptions, the levels of awareness, treatment and control may be improved. National campaignsthat focus on hypertension awareness and education concerning modifiable risk factors should be implemented to enhance public consciousness about this issue in Lebanon.

6-222

Category: Psychotherapy / Neurology

Title: Three cases of risperidone drug interactions causing or prolonging hospitalization

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Case Report: This case series describes the potential risk of drug interactions with the psychotropic agent, risperidone. Patient 1 was admitted with altered mental state including visual hallucinations with a history of paranoid schizophrenia, cirrhosis secondary to chronic hepatitis C infection. He was transferred from a skilled nursing facility to the hospital for increased confusion, visual hallucinations, inability to follow instructions, and inappropriate responses to questions. His medications at admission included risperidone 2.5 mg daily and fluoxetine 20 mg daily. The risperidone dose had been increased at his facility recently, and upon admission both fluoxetine and risperidone were put on hold, his risperidone level at admission was 270.9 ng/mL (reference range 20-60 ng/mL). Fluoxetine is a potent CYP2D6 inhibitor and has been shown to increase serum risperidone levels 4-fold on average and up to 10-times the baseline concentration after 4 weeks. Patient 2 is a 68 year old male with past medical history of major neurocognitive disorder, vascular dementia, hepatitis C and benign prostatic hyperplasia. He was admitted to the emergency department from the geriatric psychiatry unit where he had been for eleven days secondary to a hypertensive emergency. During this stay, he had been started on risperidone 0.5 mg twice daily, and then reduced to 0.25 mg at bedtime due to anticholinergic side effects. He had received 5 mg of haloperidol injection and 5 mg midazolam via intramuscular injection on the day prior to admission. He presented to the emergency department with symptoms of dystonia, hyporeflexia, altered mental status, shivering and fever (40.4 degrees C). His presentation was also significant for elevated heart rate (110 bpm), prolonged QTc (474 ms), elevated serum creatinine (1.31 mg/dL) and elevated creatinine kinase (1086u/L). His antipsychotics were all held, and his neuromuscular symptoms resolved by the following day and his serum creatinine trended back to baseline within three days. Concomitant administration of risperidone with haloperidol can cause adverse effects because both agents antagonize dopamine receptors in order to minimize positive symptoms of psychoses. Through this mechanism, it is believed that the effect of CNS depression manifested as neuroleptic malignant syndrome (NMS), the quartet of altered mental status, rigidity, hyperthermia, and autonomic instability in the form of tachycardia and QT prolongation. Patient 3 was admitted for potential risperidone and lithium interaction toxicity. He is a 56 year old male with history of bipolar disorder and generalized anxiety disorder. His medications included lithium extended release 450 mg twice daily and risperidone 2 to 4 mg at bedtime. He presented to urgent care with neuromuscular symptoms for which he received treatment. The following day he presented with a lithium level of 4 mmol/L (0.6-1.0 mmol/L), which decreased to 3.0 mml/L 12 hours later

after treatment with intravenous fluids. The patient presented with confusion, bradycardia, tremor, abnormal jerking movements of his arms and shoulders and mild fasciculations of the tongue. He also had acute kidney injury with a serum creatinine of 1.76 mg/dL. All medication doses had been stable for at least two months prior other than risperidone 2 mg tablets, started two weeks prior to admission. Creatinine and lithium levels trended down to 1 mg /dL and 0.9 mmol/L respectively by day 2. Confusion and disorientation persisted through his admission and his cognitive dysfunction remained at 30 days post discharge. The addition of risperidone to this patients regimen is believed to have precipitated Patient 3s symptoms. Irreversible brain damage attributed to lithium toxicity secondary to interactions with haloperidol has been described. There is a description of a case in which lithium levels increased above two times the therapeutic range after four days of risperidone co-administration.