

ASHP 2014 Midyear Clinical Meeting

Professional Poster Abstract

1-001

Category: Administrative Practice / Financial Management / Human Resources

Title: Distance-site precepting of residents

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Purpose: Pharmacy staff at this rural healthcare system spans a distance of 225 miles. Because of this it is impractical for a single preceptor to have face-to-face interaction with 5 pharmacy residents at multiple sites with any degree of frequency. Technology was used over the course of this year to address this issue and a questionnaire to determine effectiveness of precepting residents.

Methods: Preceptors have pharmacy residents from both primary medical centers in our system. The facility also has a strong telepharmacy focus. Based on our need to become significantly more competent with telehealth issues and increase residency opportunities, the pharmacy department decided to focus on combining these components and utilizing what was learned in each for continued improvement. Each preceptor focused on using technology to meet with the pharmacy residents in both concentrated and longitudinal experience. Discussion with other preceptors who had utilized this method occurred and best practices and ideas were gathered. Attempted to complete all meetings utilizing a communication tool that allowed video and audio participation. A questionnaire was sent to preceptors and residents who were involved in this process to determine effectiveness of this approach. The preceptors and residents were asked to respond with Pros, Cons, Resident work feedback effectiveness, and issues or improvements identified. The pharmacy department also wanted to determine if this practice was worth continuing over the next residency year.

Results: Positive findings of distance precepting were obvious to the respondents and primarily dealt with 4 themes. These themes included technology working well, the ability to share a computer screen, usefulness of actively talking through questions and concerns, and not requiring driving time especially in severe winters. Cons included: technology issues, the lack of real face to face interaction, loss of non-verbal cues, difficulty overcoming unplanned absences, requirements for communication with other preceptors, and inability to help the resident with weaknesses as effectively. Resident work feedback (verbal/written) effectiveness findings include: requires a face to face meeting to become acquainted and understand the requirements of the rotation, the ability to pull up an evaluation and talk through it, and the usage of shared drives to easily communicate projects and rotations. Many issues were fixed during the course of the year with this technology but some were not easily resolved. Cons are the easiest to identify

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resulting in the longest list. Pros weighed heavier even though there were fewer identified primarily due to the overwhelming need for this to work and the fact that it did in fact work.

Conclusion: Due to the significant distance involved between sites and that the preceptors and residents are spread across that distance, it is incumbent upon the organization that commuting time is limited and that technology is utilized as effectively as possible. The use of this technology worked extremely well in many instances and is obviously a very usable system. However, additional infrastructure is required in order to make the technology work consistently.

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1-002

Category: Ambulatory Care

Title: Chronic hepatitis C treatment and eosinophilic vasculitis

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Case Report

Purpose: This is the first case report illustrating a possible relationship between chronic hepatitis C infection and eosinophilic vasculitis. Patient is followed by the dermatology service for complaint of rashes. The rashes started initially as multiple petechial lesions on both forearms and upper legs with pruritus that has been ongoing for the past 5 months, and described as pinpoint palpable purpura (PPP). Before his initial visit to the dermatology service, patient was prescribed an antihistamine by his private allergist. Medications include hydroxyzine 25mg orally twice a day as needed for itching and cetirizine for allergies. Labs showed eosinophils of 13%. Four months after his first dermatology visit, pruritic rashes had spread to the abdomen. Hydrocortisone 2.5% cream twice a day for two weeks was added to the regimen and hydroxyzine was increased to 25mg three times a day as needed. Labs showed eosinophils of 9.8%. Punch biopsy of pinpoint palpable purpura lesions was obtained and revealed eosinophilic vasculitis rather than leukocytoclastic vasculitis, a condition typically associated with chronic hepatitis C virus (HCV) infection. Two months after the last dermatology visit, patient was started on a forty-eight week course of antiviral therapy for genotype 1a/1b chronic HCV infection with weekly pegylated interferon given subcutaneously, oral ribavirin and telaprevir for first 12 weeks only. Pruritic palpable purpura rashes were present on upper legs and forearms prior to treatment. After a week of triple therapy, his dermatology visit showed pruritic PPP rashes on arms and only mild rashes on upper legs. Labs showed eosinophils of 14.2%. One month after his HCV treatment, hydroxyzine was increased to 50mg three times a day as needed because of persistent pruritus. At this time, patient had a greater than 5 log decline in HCV ribonucleic acid (RNA) by polymerase chain reaction (PCR) when compared to baseline, eosinophils of 9.8%. On week 5 of treatment, dermatology visit showed complete resolution of rashes on arms and legs but with persistent pruritus. Patients bathing regimen was modified and antihistamine dose remained unchanged. Patient completed his full course of therapy without recurrent pinpoint palpable purpura. Pruritus was managed with antihistamine and bathing regimen, and resolved on week 48 of treatment. Labs showed eosinophils of 2.6% at end of treatment. HCV RNA by PCR was not detectable on weeks 14, 24, 37, 48 and 6 months after therapy. Four weeks and five months after antiviral therapy, dermatology visits showed complete resolution of pruritus and no recurrence of pinpoint palpable purpura. Because of virologic cure and resolution of pinpoint palpable purpura with antiviral therapy, this case suggests an association between eosinophilic vasculitis and HCV infection. This case also suggests that eosinophilic vasculitis could be another extrahepatic manifestation of HCV.

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Professional Poster Abstract

1-003

Category: Ambulatory Care

Title: Impact of a pharmacist run medication therapy management clinic on appropriate gastroesophageal reflux disease treatment in patients at a rural Veterans Affairs outpatient clinic

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Purpose: The 2013 Guidelines for the Diagnosis and Management of Gastroesophageal Reflux Disease (GERD) state an eight week trial of proton pump inhibitors (PPIs) in patients with typical GERD symptoms is the first line treatment for resolving symptoms and confirming a GERD diagnosis. Unnecessary longer durations of therapy may expose patients to undue adverse risks and prescription costs. The main objective of this quality improvement project was to enhance patient care through identifying and enrolling patients receiving inappropriate long term omeprazole therapy into a pharmacist run medication therapy management (MTM) clinic to taper off omeprazole or to the lowest effective dose.

Methods: This quality improvement project was approved by the Pharmacy and Therapeutics Committee. Education was provided to pharmacists on the 2013 Guidelines for the Diagnosis and Management of GERD with emphasis placed on appropriate PPI therapy and individualization of nonpharmacologic treatments for each patient. Additional education was provided on the tapering procedures and documentation of the MTM encounter in the electronic medical record utilizing a provided template. A retrospective chart review of a sample of primary care providers patients was utilized to identify patients receiving omeprazole therapy for greater than eight weeks but less than one year for a diagnosis of GERD or without a documented indication. Patients consenting to omeprazole taper were enrolled into a pharmacy MTM clinic and followed for a four month time period for evaluation of omeprazole therapy and tapering off the medication or to the lowest effective dose. The omeprazole taper involved decreasing the patients dose every two weeks as tolerated. Patients also received education regarding nonpharmacologic methods for controlling GERD symptoms. In addition to evaluation of omeprazole taper efficacy, a cost savings analysis was performed.

Results: Twenty-two patients were enrolled into the pharmacy MTM clinic. Nine (41%) patients had no documented indication for omeprazole use. Eleven (50%) patients were initially started on high dose omeprazole (40mg/day) and 19 (86%) patients received an initial 90 day supply. The majority of patients (64%) refilled their omeprazole prescription at least once prior to enrollment in the MTM clinic. Average omeprazole dose at initial clinic appointment was 22mg/day. Upon completion of the taper, the average omeprazole dose decreased to 9mg/day. No omeprazole related adverse events were identified. The majority of electrolyte values were

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within normal limits. An estimated medication cost savings per year of \$419.63 for the 22 patients combined or \$19.07 per patient was achieved. If this cost savings is applied to the 3,526 patients receiving omeprazole within the Veterans Affairs Black Hills Health Care System, it would correlate with an estimated medication cost savings per year of \$67,240.

Conclusion: The majority of patients enrolled in the MTM clinic decreased their omeprazole dose or discontinued the medication completely. Therefore, the clinic helped decrease medication cost, pill burden, and risk of adverse effects for the patient and medication cost for the facility. Moving forward, the clinic will continue providing omeprazole tapering services to patients as requested by their primary care providers. Providers will be encouraged to follow the guidelines for the Diagnosis and Management of GERD by limiting initial omeprazole prescriptions to a 30 day supply with one refill for patients with typical GERD symptoms.

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Professional Poster Abstract

1-004

Category: Automation / Informatics

Title: Qualitative analysis of public-domain drug hierarchies for harboring FDA established pharmacologic class (EPC) concepts

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Purpose: Established pharmacologic classes (EPCs) are determined by the Food and Drug Administration (FDA) as part of the structured product label (SPL) to describe drug classes/groups. Due to the complex nature of drug data, an hierarchical organization of EPC concepts would help health care professions access and use information in SPLs, facilitate computerized clinical decision support, and provide improved interoperability between terminologies. Currently, there is no hierarchy of EPC concepts. The purpose of this project was to perform a qualitative analysis of public-domain drug hierarchies as candidates of for harboring the development of an EPC concept hierarchy.

Methods: Hierarchies under consideration included the Anatomical Therapeutic Chemical (ATC) classification hierarchy, Medical Subject Headings (MeSH) hierarchy, National Cancer Institute thesaurus (NCIt), National Drug File Reference Terminology (NDF-RT), and the Systematized Nomenclature of Medicine Clinical Terms (SNOMED-CT) hierarchy. NDF-RT and NCIt were excluded from the analysis because NDF-RT consists of disjoint hierarchies and does not allow for the development of a single EPC hierarchy, and the NCIt use case is mainly cancer centric. The three hierarchies, ATC, MeSH, and SNOMED-CT, were then evaluated by two pharmacists using the following domains of ontology evaluation: completeness, correctness, consistency, concept orientation, formal definitions, multiple granularities, structure, subset capability, maintainability, class descriptions, and classification method. Each domain was evaluated using a five-point Likert scale. The analysis consisted of descriptive statistics and a weighted kappa statistic for inter-rater consistency. Additionally, we attempted to manually map 20% of the EPC concepts (n=108) using mainly lexical matching. There were no hierarchical limitations for ATC mappings. MeSH mappings were limited to the Chemicals and Drugs hierarchy, with a focus on the Chemical Actions and Uses sub-hierarchy. SNOMED-CT mappings were limited to the Pharmaceutical/biologic product and substance hierarchies. Current EPC concepts were downloaded from the FDA DailyMed.

Results: There was good agreement (84% agreement, kappa =0.56, p-value <.001) in the domain ratings, results table to be reported on poster. Successful manual mappings where: ATC, 61/108 =56.5%; MeSH, 58/108 =53.7%; and SNOMED-CT, 77/108 =71.3%. Although ATC had more lexical matches than MeSH, its model is not conducive to harbor EPCs or provide easy

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navigation, as the EPCs are not bound by anatomical classifications and there are inconsistent representations of concepts across anatomical and therapeutic classes in ATC. MeSH was limited due to its purpose as a controlled vocabulary thesaurus. MeSH uses only is_a relationships without providing other useful definitional relationships. In addition, several of the MeSH classifications were found to be very broad and flat, and do not easily support the granularity of the EPCs. SNOMED-CT, with the breadth and depth of the Pharmaceutical/biologic product and/or substance hierarchies would most easily support the diversity and granularity of EPCs. SNOMED-CT attributes, such as has_active_ingredient (attribute), would support useful navigation and subsetting of EPCs as needed for diverse use cases. Additionally, SNOMED-CT utilizes sound ontological principles, has robust curation, and has been designated in the U.S. as the standard for electronic health information exchange and interoperability for many clinical domains.

Conclusion: In conclusion, of the three public-domain drug class hierarchies evaluated, SNOMED-CT offered the most consistent representation of the EPC concepts. We are currently working on manually mapping EPC concepts to SNOMED-CT in order to develop a drug class hierarchy using EPC concepts. To assist with the mappings, we are utilizing lexical and instance-based matching techniques.

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1-005

Category: Automation / Informatics

Title: Instance-based matching of FDA Established Pharmacologic Class (EPC) concepts to the Anatomical Therapeutic Chemical (ATC) classification system

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Purpose: The Food and Drug Administration (FDA) uses established pharmacologic classes (EPCs) to group and classify active ingredients as part of the structured product label (SPL). Instance-based matching is a method for comparing the overlap of drug classes based on a pairwise comparison of active ingredients in each drug class. The purpose of this project was to perform instance-based matching to determine semantic similarity of drug class groupings between EPC concepts to those in the Anatomical Therapeutic Chemical (ATC) classification system.

Methods: We downloaded EPCs and their active ingredients from DailyMed (4-24-2014_spl_index), and used RxNorm APIs (RxMix) to get active ingredients for ATC classes (06/04/2014). We mapped active ingredients using RxCUIs from RxMix. Each EPC was compared to each ATC class in a pairwise manner if the classes shared at least one active ingredient. All ATC drug class levels were included (1-4). We calculated an equivalence score (ES) using a modified Jaccard similarity coefficient, modified for comparing groups with few instances. The ES ranges from 0 to 1, with 0 representing no equivalence, 1 representing perfect equivalence, and >0.25 representing potential equivalence based on overlap of the active ingredients. To account for different levels of granularity between drug classes, we calculated an inclusion score (IS) to determine if an EPC was potentially included as part of a larger ATC class, or vice versa. The IS ranges from -1 to 1, with -1 representing the ATC class being a subclass of the EPC concept, 0 representing even distribution of active ingredients not shared by the classes, and 1 representing the EPC concept being a subclass of the ATC class. An IS score less than -0.5 or greater than 0.5 indicated similarity by inclusion.

Results: Of the 483 identified EPCs, 403 (83.4%) were associated with at least one ATC class. 754 (78.0%) of the 967 identified ATC classes were associated with at least one EPC. 80 EPCs and 213 ATC classes were not included because they were empty, their active ingredient instances could not be mapped to RxCUIs, or their active ingredients are currently outside of the scope of RxNorm (such as allergens, foods, etc.). ATC also included additional combination drugs and active ingredients not used in the US that were not included in this evaluation. Overall, there were 1,058 active ingredients identified by RxCUIs that are shared between the two classification systems, for a total of 303,862 possible drug class comparisons. Of the 5,729 drug

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class combinations that shared at least one active ingredient, we characterized 1,762 (30.8%) as potentially equivalent (ES >0.25), 840 (14.7%) as equivalent (ES >0.5), 1,157 (20.2%) EPCs as subclasses of ATC classes (IS >0.5), and 3,195 (55.8%) ATC classes as subclasses of EPCs (IS <-0.5). Of note, 780 (13.6%) classes had an ES >0.5 and significant IS score. The semantic similarity between EPCs and ATC classes, by aggregating the maximum inter-set ES values, was determined to be 58.6%.

Conclusion: We performed instance-based matching between EPC concepts and ATC classes to determine semantic similarity between the two drug classification systems. We found EPC concepts to be 58.6% similar to ATC classes. This evaluation and instance-based method are important for aligning EPCs and ATC classes. This type of mapping/alignment could be used for providing a hierarchical structure to EPCs for use in clinical decision support. This study is limited in that it only included a qualitative comparison between the classification systems, and did not evaluate the appropriateness of the matches. Comparison to an expert-reviewed, manually-mapped, gold standard is desirable.

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1-006

Category: Cardiology / Anticoagulation

Title: Evaluation of dabigatran utilization and discontinuation

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Purpose: Dabigatran was approved in the United States by the FDA in October 2010 for the prevention of stroke due to non-valvular A-fib. Dabigatran provided patients with an alternative to warfarin therapy. Since that time, the use of dabigatran and other novel oral anticoagulants has increased. This project was performed at a rural VA and was designed to identify the total number of patients that had been initiated on dabigatran and the number of patients that remained on active therapy or had discontinued therapy during the study period. Finally, reasons for dabigatran discontinuation were identified.

Methods: A computer report was generated to include all patients possessing an active prescription for dabigatran between the time periods of March 2011 to March 2014. A chart review was then conducted by a fourth year pharmacy student to determine the number of patients remaining on active therapy. Further investigation was conducted on patients that had stopped therapy during the review period. Reasons for discontinuation were grouped into 8 categories: bleeding, GI upset, itching, heartburn, thromboembolic event, renal, other, and unknown.

Results: A total of 119 patients were started on dabigatran during the review period. Of these, 78 (66%) remained on active therapy at the end of the review period and 41 (34%) patients had discontinued therapy. Of the 41 patients that discontinued therapy, 17 patients discontinued therapy due to adverse drug reactions (bleeding, GI upset, itching, heartburn and dizziness), 4 patients experienced thromboembolic events while on dabigatran, 3 patients experienced MI, 3 patients were changed to warfarin due to renal issues with dabigatran, and 14 patients discontinued for other reasons. Three patients died while on dabigatran therapy: one due to CVA, one due to CHF, and one due to unknown causes.

Conclusion: As the use of dabigatran and other novel oral anticoagulants becomes more common, patient counseling, as well as monitoring and addressing adverse events related to their use will continue to be important. Pharmacists can expect to play a large role in this, in both community pharmacy settings as well as pharmacy run anticoagulation clinics.

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1-007

Category: Cardiology / Anticoagulation

Title: Determine elements that increase medication adherence in a heart failure post-discharge clinic

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Purpose: Heart Failure (HF) affects approximately 5.1 million Americans. HF has a 5-year untreated mortality rate of 50%. About 50% of HF patients experience a 90-day re-hospitalization rate, which leads to increased costs and poor outcomes. Barriers to preventing readmissions may include low literacy, cognitive function, financial hardship, psychological disorders, and little social support. This questionnaire was designed to demonstrate areas that potentially increase medication adherence.

Methods: Forty patients were interviewed during their initial appointment at the Heart Failure Post-Discharge clinic. During each patient clinic visit, six questions regarding medications were asked to all HF patients. Results of the questionnaire were analyzed using 2 X 2 cross tabulation tables and expressed in percentages. Cross tabulation performed in the following categories: 1) adherence*pillbox; 2) adherence*cost; and 3) adherence*knowledge

Results: In the first category (adherence*pillbox); 70% of patients were adherent who use a pillbox and 30% of patients were adherent who did not use a pillbox. In the second category (adherence*cost); 94% of patients were adherent who can afford their medications and 92% of patients were adherent who stated that they cannot afford their medications. In the third category (adherence*knowledge); patients who 82% of patients takes some medications correctly if they have some knowledge about their HF medications; 28% of patients takes some medications correctly if they have some knowledge. 52% of patients who indicated that they know all of their HF medications took all of their medications daily. 15% of patients took some of their medications correctly who did not have knowledge of their any of HF medications. 19% of patients took all of their medications correctly who did not have knowledge of their HF medications.

Conclusion: Patients knowledge revealed a trend toward improved medication adherence. In this patient population, the cost of medications did not demonstrate any significant improvement in medication adherence. Patients use of a pillbox did not demonstrate any significant benefit in patient adherence. Pharmacists should focus on increasing a patients medication knowledge in efforts to increase medication adherence and decrease hospital re-admissions

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1-008

Category: Cardiology / Anticoagulation

Title: Impact of a pharmacist-run interdisciplinary hypertension shared medical appointment at a rural veterans affairs health care system

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Purpose: Patients with uncontrolled hypertension are at a higher risk of mortality. As of July 2013, the Veterans Health Administration (VHA) had 2,880,281 patients diagnosed with hypertension. Based on previous studies, improved blood pressure control can be achieved using an interdisciplinary approach. The primary objective of this quality improvement project was to evaluate improvement in blood pressure control and patients disease state knowledge through a multidisciplinary hypertension shared medical appointment (SMA).

Methods: Prior to commencement, this prospective quality improvement project was submitted to the Pharmacy and Therapeutics committee for approval. Patients who had not met their blood pressure goal and had been seen by their primary care provider at least once since January 2013 were contacted to participate in a SMA. Primary care providers, nutritionists, a Health Behavior Coach (HBC), the Health Promotion Disease Prevention coordinator (HPDP), Care Coordination Home Telehealth (CCHT) personnel and nursing were all informed of SMA operations in order to improve patient referral into this group. The interdisciplinary team consisted of a pharmacist, nutritionist, psychologist and nurse educator. Patient education at the SMA consisted of medication information, psychological barriers to blood pressure lowering, proper use of home blood pressure monitors and appropriate dietary choices. Blood pressure and pulse were obtained at each SMA. Follow-up occurred at either the patients last SMA attended or the Patient Aligned Care Team (PACT) appointment following the last SMA attended, comparing baseline blood pressure to post-SMA blood pressure. A patient questionnaire was utilized before and after each SMA session to assess the utility of the SMA and each patients perceived level of knowledge prior to and after attending the SMA.

Results: Seventy-five veterans were evaluated and invited to the hypertension SMA between November 2013 and March 2014. Five different patients came to the hypertension SMAs between November 2013 and March 2014. The median blood pressure between all patients prior to the SMA was 132/82. The median blood pressure between all patients after the SMA was 126/64. One patient was referred to the SMA due to hypotension; when these results are excluded, the median blood pressure prior to the SMA is 146/82, and after the SMA is 128/68. The questionnaire contained eight questions evaluating the patients perceived ability to control their blood pressure, diet, exercise, minimize future health outcomes, similarities and differences from other patients blood pressure related problems, how worried they are about their high blood

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pressure affecting their health and how usefulness of group discussion. Using a Likert scale, the question yielding the largest change in perception, asked patients how strongly they felt that they could control their blood pressure: Pre-SMA averaged 3.3 whereas Post-SMA averaged a 1.8 showing that after the SMA patients learned ways to improve control of their blood pressure.

Conclusion: Despite some limitations, each patient seen during the questionnaire period was able to attain blood pressure control based on their comorbid disease states or provider recommended goal. Overcoming barriers such as patient travel requirements and increasing PACT team awareness of and referral to this program will help improve the sustainability of the SMA.

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1-009

Category: Cardiology / Anticoagulation

Title: Evaluation of the effect of warfarin loading doses on the duration of enoxaparin bridging

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Purpose: To assess the safety and efficacy of warfarin loading doses through evaluation of enoxaparin usage in patients receiving initial loading doses of warfarin versus initial estimated maintenance dosing. Loading dose was defined as a first and/or second warfarin dose greater than or equal to 20 percent higher than predicted maintenance dose. The recent ACCP Chest guidelines changed from a strong recommendation for initial doses between 5 and 10mg for most individuals, to a weak recommendation of 10mg for 2 days for healthy outpatients. Appropriate starting dosage of warfarin continues to be ambiguous necessitating further research.

Methods: The institutional review board approved this retrospective chart review. Men and women aged 18 to 89 initiated on warfarin for atrial fibrillation or thromboembolism during an inpatient admission bridged with enoxaparin therapy (without other anticoagulant use) were included. Patients were excluded if they had heart valve replacements, received warfarin in the last 30 days, had orthopedic surgery within last 42 days, received therapeutic dose of heparin at warfarin initiation, completed warfarin initiation for atrial fibrillation without bridge therapy, or received fondaparinux, argatroban, lepirudin, bivalirudin, rivaroxaban, or dabigatran within the previous 30 days. Sixty-five patients per group were needed for 80 percent power to detect a 20 percent difference between groups for the primary outcome of number of days of enoxaparin therapy utilized during the warfarin initiation phase. Secondary outcomes assessed (in first 28 days of therapy) included time to therapeutic INR, number of laboratory values collected for INRs, number of warfarin dosing adjustments required, number of patients with INR values greater than or equal to 4, number of patients with adverse events including bleeding, thrombosis, need of reversal agent, those requiring clinic, urgent care, or emergency room visit or inpatient admission, and number of enoxaparin doses dispensed.

Results: Eighty-three patients were identified for enrollment in the study period. Thirty-one received a loading dose and 52 received initial maintenance doses of warfarin. The maintenance dose patients injected a mean of 18 days of enoxaparin compared to 15 days in loading dose patients (p equals 0.10). Patients initiated on maintenance dose compared to loading dose had an average hospital stay of 3.7 versus 4.1 days, a mean number of days to an INR greater than 2 of 11.3 and 6.8, and mean number of days of enoxaparin therapy dispensed of 13 and 11, respectively. The number of patients experiencing bleeding (requiring inpatient admission, reversal agent, or clinic/urgent care/emergency room visit) or thrombosis was 10 and 5 for maintenance dose and loading dose groups, respectively. Number of INR values greater than or

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equal to 4 was 20 in the maintenance dose group (1 result per 2.6 patients) and 10 in the loading dose group (1 result per 3.1 patients). The number of warfarin dosing adjustments required was not significantly different with a mean of 1.7 and 1.6 for the maintenance and loading dose groups.

Conclusion: This study did not detect statistically significant differences between groups in the use of enoxaparin, although only 83 patients were enrolled. Time to therapeutic INR and days of enoxaparin use were numerically lower in patients with loading dose use, but rates of INR results greater than or equal to 4 were similar. As a disadvantage to prescribing loading doses, increased bleeding rates did not occur in this study. Despite lack of power this data suggests further investigation may demonstrate a significant difference in clinically pertinent medication use and clinical endpoints between use of initial warfarin maintenance or loading doses.

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Professional Poster Abstract

1-010

Category: Chronic / Managed Care

Title: Impact of an outpatient heart failure clinic on readmission rates

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Purpose: Hospital readmission rates within 30 days after heart failure hospitalization are a national performance metric. Some factors contributing to hospital readmissions include: inappropriate in-hospital care, insufficient discharge planning, uncoordinated transitions of care, and inadequate post-discharge/follow-up care. Studies suggest early physician follow-up discharge is associated with a decrease in readmission. The Dayton VAMC interdisciplinary outpatient Heart Failure clinic was implemented in November of 2012. This quality improvement project was conducted to evaluate the impact of follow-up with the Dayton Veterans Affairs Medical Center (VAMC) outpatient Heart Failure clinic on readmission rates during its first year.

Methods: The Veterans Integrated Service Networks (VISN) 10 Decision Support Services was consulted to obtain the data. Data on all patients discharged with a primary diagnosis of Heart Failure in the 2012 and 2013 fiscal year at the Dayton VAMC was collected. Data was collected on age, gender, comorbidities, weight, blood pressure, body mass index (BMI), serum creatinine, admissions for Heart Failure, and length of hospital stay. The time from hospital discharge to initial Heart Failure encounter was determined. The 30-day readmission rate for Heart Failure was calculated. To test for differences, t-tests was used for continuous variables and Fishers exact test was used for categorical variables.

Results: A total of 128 patients from 2012 and 140 patients from 2013 met inclusion criteria. The 30-day readmission rates for 2012 and 2013 were 49% and 39%, respectively. The mean number of days to follow-up with the Dayton VAMC Heart Failure clinic following discharge in 2012 and 2013 was 52 and 19 days, respectively. Also in 2013, 61% of patients were seen by HF clinic within 2 weeks. Forty patients were lost to follow-up in 2013.

Conclusion: The newly implemented outpatient Heart Failure clinic at the Dayton VAMC reduced readmission rates in 2013 by nearly 10% in its first year. Following a hospital discharge for Heart Failure, patients had an average shorter time to follow-up with a healthcare provider by 33 days in 2013 compared with 2012.

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1-011

Category: Drug-Use Evaluation

Title: Evaluation of the efficacy and safety of gemigliptin, linagliptin and saxagliptin-dipeptidyl peptidase-4 inhibitors-in elderly patients

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Purpose: Dipeptidyl peptidase-4 (DPP-4) inhibitors are hypoglycemic agents that have a unique insulinotropic action, which increases incretin levels, which in turn improve glucose control by inhibition of glucagon release. DPP-4 inhibitors are not only effective in blood glucose control but also cause less increase in body weight and less adverse reaction of hypoglycemia. Owing to these advantages, DPP-4 inhibitors are widely used to treat type II diabetes mellitus, especially in elderly patients. Thus, this study attempts to evaluate the efficacy and safety of gemigliptin, linagliptin and saxagliptin-recently introduced DPP-4 inhibitors-in elderly patients.

Methods: This retrospective investigation included patients with an age of sixty years or older at the outpatient department. They were administered with gemigliptin (November, 2013~April, 2014), linagliptin (November, 2013~April, 2014) and saxagliptin (November, 2012~April, 2014) for the first time. This study utilized electronic patient records from this hospital as these patients were divided into two groups: (1) the drug-added group, to which a DPP-4 inhibitor was administered concurrently with currently-taking hypoglycemic agent(s), and(2) the substitution group, for which one of the currently-administering hypoglycemic agents was replaced with a DPP-4 inhibitor. The levels of hemoglobin A1c(HbA1c), fasting blood sugar(FBS) and 2-hour postprandial glucose(PP2) were taken before and after administration of the corresponding DPP-4 inhibitor. The efficacy through evaluations of these levels was compared between these two groups while the aspect of safety was examined through finding adverse reactions from patient records.

Results: Seventy-nine out of 748 patients were administered with the DPP-4 inhibitor for the first time, after excluding patents for lack of test records or changing more than one drug for diabetes mellitus. They were assessed by dividing them into the drug-added group with 51 patients and substitution group with 28. Regarding the drug-added group 3~4 months after administration of the DPP-4 inhibitor, the HbA1c levels significantly decreased from 8.1+/-1.2% to 7.6+/-1.1%(P<.001) while the FBS levels significantly decreased from 152.4+/-43.7 mg/dL to 132.3+/-43.2mg/dL(P=0.001). The PP2 levels significantly decreased from 307.1+/-54.2 mg/dL to 260.8+/-61.2 mg/dL(P<.001). Regarding the substitution group, the HbA1c levels decreased from 7.5+/-1.2% to 7.2+/-1.1%(P=0.020). The FBS levels did not show differences changing

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from 133.0+/-43.8mg/dL to 133.3+/-42.6mg/dL(P=0.977), while the PP2 levels decreased significantly from 284.7+/-56.1 mg/dL to 233.7+/-63.7 mg/dL(P=0.001). Regarding experiencing adverse reactions, the substitution group had 3 patients with a hypoglycemic episode prior to drug administration. One of these 3 patients and another patient in the substitution group experienced a hypoglycemic episode after drug administration . No patient in the drug-added group had a hypoglycemic episode before drug administration, but 2 patients in the same group had a hypoglycemic episode after drug administration .

Conclusion: The results of this study showed that efficacy significantly improved in both levels of HbA1c and PP2 for both groups. Nevertheless, efficacy significantly improved in FBS levels only for patients in the drug-added group. Regarding adverse reactions, the number of hypoglycemic episode increased from 3 patients before administration of a DPP-4 inhibitor to 4 after administration of a DPP-4 inhibitor. The limitations of this study were: (a) that this new drug investigation had a short duration of drug administration and (b) a small number of subjects. Therefore, further prospective long-term studies are necessary in the future.

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Professional Poster Abstract

1-012

Category: Emergency Medicine / Emergency Room

Title: Implementation of clinical pharmacy services in the emergency department at a rural Veterans Affairs healthcare system: results from a quality improvement project

Primary Author: Shawn Dalton; Email: sdalton1128@gmail.com

Additional Author(s):

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Purpose: The emergency department (ED) has a fast-paced environment with a primary focus of delivering safe, effective, and immediate care. However, the inherent pace required to see multiple patients and emergencies creates the ideal setting for medication and medical errors. Evidence has shown that implementation of clinical pharmacy services increases patient safety, improves quality of care, and likely promotes cost-reductions within the ED. The goal of this project was to implement and assess the impact of clinical pharmacy services in the ED.

Methods: This quality improvement project was approved by the Pharmacy and Therapeutics Committee prior to commencement. ED staff anonymously completed a 24 item pre-implementation questionnaire assessing their beliefs regarding the implementation of clinical pharmacy services. The questionnaire utilized a five-point scale with responses ranging from one (strongly agree) through five (strongly disagree). The questionnaire was divided into six categories and each category had a varying number of statements. Following the pre-implementation questionnaire, the Post-graduate Year Two (PGY2) pharmacy resident was available on Mondays and a residency trained pharmacist was available on other days of the week for a total of 30 days. Following implementation of clinical pharmacy services, a 24-item post-implementation questionnaire was completed by ED staff. Pharmacy staff was blinded from respondent identifiers to protect anonymity and reduce bias. Pharmacist interventions were tracked and divided into two categories: cost-avoidance interventions (CAI) and non-monetary interventions (NMI). Each category contained specific types of interventions to facilitate accurate tracking and documentation of pharmacist interventions. Dollar values were assigned to each type of CAI and data was extrapolated to give an estimated yearly cost-avoidance based on pharmacist interventions. NMI were tracked to better capture daily workload information.

Results: Sixty-six percent of ED staff responded to the pre-implementation and 29% responded to the post-implementation questionnaires. One-hundred percent of pre- and post-implementation questionnaire respondents agreed or strongly agreed that an ED pharmacist would (pre-implementation) and did (post-implementation) improve the quality of care. Ninety-seven and one-half percent of pre-implementation and 100% of post-implementation questionnaire respondents agreed or strongly agreed that the pharmacist would be (pre-implementation) and was (post-implementation) a quality source for drug consultation. Eighty percent of pre-

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implementation and 100% of post-implementation questionnaire respondents agreed or strongly agreed that the pharmacist would (pre-implementation) and did (post-implementation) improve patient safety. Differences in response rates for the pre- and post-implementation questionnaires were small overall. A total of 292 interventions were documented during the 30 day period. CAI were documented 170 times and NMI were documented 122 times. Ninety-seven percent of CAI were accepted by providers. Estimated cost-avoidance over the 30 day period was \$26,069. Extrapolated cost-avoidance for an estimated work year (240 days) equaled \$208,552. Patient counseling, drug consultation, and dose evaluation were the most frequent CAI. Answering drug information questions and providing verbal hand-off communication for patients admitted to the hospital were the most frequent NMI.

Conclusion: Questionnaire results suggest that ED staff highly value the presence of an ED pharmacist. Small differences in questionnaire responses may be attributed to alternative staff members completing each questionnaire, lower number of respondents for the post-implementation questionnaire, high ED staff turn-over, and/or lack of daily pharmacist availability. Intervention results suggest that the cost of adding a pharmacist to the ED would be offset by increased patient safety, improved care quality, and cost-avoidance that exceed an average pharmacist salary in the region. Results of this project were used to create a business plan and seek a full-time ED pharmacy position.

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Professional Poster Abstract

1-013

Category: Emergency Medicine / Emergency Room

Title: Improving pharmacy services in the emergency department without a dedicated pharmacist

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Purpose: Pharmacist services in the emergency department (ED) are seldom found per ASHP survey of hospitals from 2005 where only 3.5% had a dedicated pharmacist and only 5% reviewed medications prior to dispensing. Dedication of a pharmacist can be difficult for many reasons. Due to the potential for medication errors in this environment, the need for pharmacy presence is important. While there is not a dedicated pharmacist at VA Black Hills HealthCare System, we have improved the services we provide in the ED.

Methods: Prior to this quality improvement project being implemented in the summer of 2009, medications were not entered or verified by a pharmacist. From 2009-2011, many attempts were made to get orders entered through reports from the automated dispensing cabinet. In the Fall of 2011, inpatient medications as outpatient (IMO) was implemented and then was transitioned into clinic orders (CO) in June of 2014. Both of these methods improved the computerized entry of a medication order by providers and additionally, provided a method to pull the medication from the automated dispensing cabinet from the patients profile.

Results: After this projects implementation, all medications provided in the ED have an order, are checked with the electronic allergy and drug-drug interaction system and the medication order is finished prior to the patient receiving it (unless it is an emergent medication). Due to IMO and CO, medications are pulled from a profiled cabinet and there is less room for error.

Conclusion: Having a dedicated pharmacist in the ED would be ideal, but when that is not an option there are many other services the pharmacist can provide to improve patient care. Additionally, pharmacy has worked a great deal with providers and nursing staff which has built a strong team and demonstrated the desire for additional clinical services.

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Professional Poster Abstract

1-014

Category: Infectious Diseases

Title: Sero-negative immunization titers for measles-mumps-rubella and hepatitis b in healthcare personnel, and evaluation of subsequent vaccine re-administration

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Purpose: Failure of the measles, mumps, rubella (MMR) or hepatitis B immunizations may place healthcare personnel (HCP) at risk. The recent increase in pertussis despite highly vaccinated populations highlights a need to reassess accepted vaccination recommendations. The United States Veterans Affairs (VA) checks new employee immunization titers, rather than simply accepting written documentation as proof of immunity. This study compared the efficacy of the MMR and hepatitis B vaccinations for healthcare personnel in Nebraska VAs to vaccine effectiveness provided by the Centers for Disease Control. This study also evaluated if HCP with sero-negative titers received the appropriate re-administration of the vaccinations.

Methods: This retrospective data analysis was approved by the Omaha VA institutional review board. All protected health information was removed, and through the use of Microsoft Structured Query Language (SQL) with data from the VA data warehouse HCP with a sero-negative or sero-equivocal immunization titer were identified. Initial numerical data suggested that 1200 HCP profiles would have sufficient pertinent data, and so the limitation was placed at 1500 randomized HCP profiles to account for any SQL string errors and provide a sufficient randomized population for statistical power. The Chi-square test was used to determine if there was a significant difference between current HCP immunization effectiveness and the effectiveness rates noted by the Centers for Disease Control. This study also documented if identified HCP received subsequent re-vaccination when a sero-negative or sero-equivocal immunization titer was observed.

Results: The final SQL string resulted in approximately 6,000 unique HCP profiles and approximately 1500 unique immunization titers for employees that worked in the Nebraska VA clinics in the evaluation period. Approximately 4,000 of the unique HCP profiles did not have any information associated with them, other than a documented age. Twenty-two of 407 (5.4%) HCP were sero-negative for measles as compared to 1% from the CDC statistics ($p < 0.001$). There were 494 out of 1,414 (34.9%) HCP that were sero-negative for hepatitis B as compared to 10% from the CDC ($p < 0.001$). The incidence of sero-negative results for mumps were approximately the same when compared, and although there were insufficient numbers to assess the rubella vaccine titers there was a trend showing an increase in sero-negative results when

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compared to the CDC. The only significant re-administration of immunizations for healthcare personnel was with sero-negative hepatitis B titers, with a likelihood ratio of 154.45 ($p < 0.001$).

Conclusion: This study demonstrated that of the 1500 unique healthcare personnel, 617 of them may not have had adequate protection with the current immunization recommendations. The current immunization effectiveness proposed by the Centers for Disease Control for hepatitis B and measles may not be as high as previously thought. Healthcare personnel may be at risk if exposed to these diseases, and due to this risk further studies are needed to be done to assess the protective nature of current immunization practices.

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Professional Poster Abstract

1-015

Category: Infectious Diseases

Title: Evaluation of antibiotic prescribing practices for pneumonia at a tertiary academic medical center: a quality improvement project

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Purpose: Excessive durations of antibiotics for the treatment of pneumonia increase the risk for antibiotic resistance, adverse effects, increased costs, and an extended length of stay for patients in tertiary care hospitals. The American Thoracic Society (ATS)/Infectious Disease Society of America (IDSA) guidelines recommend therapy duration of 5-7 days for uncomplicated community-acquired pneumonia (CAP) and 7-8 days for uncomplicated healthcare-associated pneumonia (HCAP). The purpose of this project was to evaluate prescribing practices and consistency with current guidelines for the treatment of uncomplicated pneumonia in a hospitalized veteran population to target areas for improvement.

Methods: This retrospective cohort review was conducted for quality improvement purposes and IRB approval was not required. Patients older than 18 years of age admitted for at least 48 hours with a primary diagnosis of pneumonia and treated within 48 hours were included. Patients were excluded if diagnosed with complicated pneumonia (lung abscess, empyema, necrotizing pneumonia, severe immunosuppression, extrapulmonary infection), transferred from another facility, hospitalized more than 14 days, or recently discharged with pneumonia. Two hundred cases from 2012-2013 were screened and the following data were collected: demographics, healthcare exposure criteria used to define HCAP, vital signs, laboratory results on admission, admitting ward, sputum and blood microbiology results, administration times and route for antibiotics prescribed during hospitalization and discharge, evidence of CDI, readmission within 28 days of discharge. The primary outcome was the proportion of patients admitted with uncomplicated CAP or HCAP treated for a duration of therapy consistent with guideline recommendations (CAP: 5-7 days or up to 3 days beyond afebrile; HCAP: 7-8 days unless a nonfermenting gram-negative bacilli, *S. aureus*, or bacteremic). Secondary outcomes included the days of IV/PO therapy compared to total length of stay, rate of readmission within 28 days, and prevalence of empiric antibiotic selection.

Results: One hundred nineteen patients met inclusion criteria; 88 with CAP and 31 with HCAP; 93% were admitted to a non-ICU setting, the average age was 68 and the average PSI score was 102. The proportion of patients treated for durations consistent with ATS/IDSA recommendations was 37.5% for CAP with median 10.5 days (4.05 days IV, 0.95 days PO, and 5.5 days post discharge), and 37% for HCAP with median 10 days (5 days IV, 0 days PO, and 5 days post discharge). Mean length of stay was 5 and 6 days for CAP and HCAP respectively.

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All-cause readmission rate among those treated for the recommended duration was 15% (2 CAP, 4 HCAP), compared to 10.4% (4 CAP, 3 HCAP) for those treated beyond recommended durations; this was not a statistically significant difference ($p=0.54$) using Fishers exact test. Empirical antimicrobials for CAP included primarily fluoroquinolone monotherapy (51%) and ceftriaxone-azithromycin (19.3%). Empirical antimicrobials for HCAP included piperacillin/tazobactam-vancomycin (25.8%), piperacillin/tazobactam-vancomycin-fluoroquinolone (16.1%), and fluoroquinolone monotherapy (16.1%). Ninety-five percent of patients had blood cultures drawn and 45% had sputum cultures. Significant organisms were identified in 3.5% of blood and 22% of sputum cultures, while 7% of blood cultures were considered contaminated with coagulase negative staphylococcus.

Conclusion: The majority of patients in this review were treated with antibiotics for uncomplicated pneumonia longer than guideline recommendations despite relatively short lengths of stay (LOS). While readmission rates were lower in patients treated with longer courses, this may be due to small group sizes. Several areas were identified for improvement. Extended durations of therapy resulted primarily from prolonged courses of discharge antibiotics. Patients were also treated with long courses of inpatient IV therapy relative to their LOS and clinical stability. Blood cultures, drawn in both ICU and non-ICU patients, were of limited usefulness.

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Professional Poster Abstract

1-016

Category: Infectious Diseases

Title: Evaluation of procalcitonin use for bacterial infections at a VA medical center

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Purpose: To determine if the availability and use of procalcitonin (PCT) without formal provider education or an interpretive algorithm resulted in decreased antibiotic use without negatively impacting patient outcomes

Methods: Using retrospective data, we evaluated patients with at least one PCT level ordered between January 1, 2013 to August 31, 2013. Patients with thyroid cancer were excluded. We evaluated patterns of PCT ordering, and whether antimicrobial use patterns were concordant with a proposed PCT algorithm based on recommended guidelines: < 0.1 mcg/L, strongly discourage; < 0.25 mcg/L (considered negative), discourage or consider discontinuation/de-escalation; 0.25-0.5 mcg/L, encourage; and > 0.5 mcg/L, strongly encourage. We also evaluated the impact of PCT use on antibiotic discontinuation and the predictive value of PCT for established infections. Descriptive statistics were used to describe continuous variables, the Students t test for comparative statistics, and the Chi-squared or Fishers exact tests for nominal data. A p value < 0.05 was considered statistically significant.

Results: We identified 171 patients who had a total of 402 PCT levels. PCT was primarily ordered in the intensive care units, accounting for 69.9% of all values; 131 (32.6%) of tests results were <0.25 mcg/L. Twenty-three percent of low PCT levels <0.25 mcg/L resulted in antimicrobial discontinuation/de-escalation within 48 hours. PCT was primarily ordered for established indications (51.5%): LRTIs (36.3%), sepsis (9.4%), and COPD exacerbation (5.8%). Only 49.4% of PCT levels <0.25 mcg/L correlated with patients who were infection-free on clinical grounds; however the positive predictive value of the proposed PCT algorithm was 88.3%. Antibiotic discontinuation based on PCT levels was not associated with increased mortality (p=1).

Conclusion: PCT had a high positive predictive value in our clinical setting, but its use was inconsistent with established guidelines. Provider education is recommended to improve its usefulness.

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Professional Poster Abstract

1-017

Category: Investigational Drugs

Title: Curcumin-loaded nanoparticle ameliorated retinal function in Best vitelliform macular dystrophy-specific induced pluripotent stem cells

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Purpose: Best vitelliform macular dystrophy, also known as Best disease (BD), is a form of inherited juvenile-onset macular degeneration. Although its pathogenesis has been linked to the mutation of retinal pigment epithelium (RPE) Bestrophin-1, effective therapeutics against BD have not been identified. The aim of this study is to explore whether nanomedicine-based therapy using curcumin is effective for BD therapy.

Methods: We isolated BD patient-derived dental pulp-derived cells to generate patient-specific induced pluripotent stem cells (BD-iPSCs) and then differentiated BD-iPSCs into RPE-like cells (BD-RPEs) that were used as an expandable platform for in vitro drug screening. We employed several techniques such as flow cytometry, quantitative real-time reverse-transcriptase (RT)-PCR, miRNA/mRNA-microarray analysis in this study.

Results: Compared with unaffected sibling-derived iPSC-derived RPE cells (ctrl-RPEs), BD-RPEs exhibited normal RPE-specific markers but had a lower expression of the tight junction protein zonula occludens-1 (ZO-1) and Bestrophin-1 as well as reduced phagocytic ability. Among several candidate drugs that were screened, curcumin was the most effective for upregulating both the Bestrophin-1 and ZO-1 genes in BD-RPEs. To ensure the sustained release of curcumin, we encapsulated curcumin with PLGA nanoparticles. PLGA-coated curcumin nanoparticles (Cu-NPs) were efficiently internalized into BD-RPEs and restored both ZO-1 and Bestrophin-1 levels, as well as phagocytic ability and the function of voltage-dependent calcium channels.

Conclusion: In conclusion, our findings demonstrated that nanomedicine-based therapy using curcumin may be an effective option for personalized BD therapy.

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Professional Poster Abstract

1-018

Category: Pain Management

Title: Assessment of opioid plus benzodiazepine utilization in patients with chronic non-cancer pain and co-morbid mental health diagnoses at a rural Veterans Affairs healthcare system

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Purpose: In 2013, this healthcare system initiated an opioid safety initiative that focused on strategies to reduce high-dose opioid analgesic and oxycodone SA utilization. These two objectives were selected due to their direct correlation with adverse events and unintentional overdose. Recent national data has confirmed that opioid analgesics are the most frequently identified medications in pharmaceutical overdose deaths. Additionally, the data analysis determined that opioid plus benzodiazepine (BZD) utilization accounted for more deaths than any other medication combination. The purpose of this quality improve project was to assess for concurrent utilization of opioids plus BZDs.

Methods: This quality improvement project was approved by the Pharmacy and Therapeutics Committee prior to commencement. A chart review was conducted to identify all chronic non-cancer pain (CNCP) patients who received prescriptions for opioid analgesics plus BZDs over a 90 day timeframe. Patients with active cancer or hospice/palliative care status were excluded from this review. The primary chart review focused on identifying the following information: primary indication for opioids, specific opioids prescribed, primary indication for BZDs, specific BZDs prescribed, additional pain medications, additional mental health medications, and the utilization of opioids plus BZDs plus z-hypnotics (i.e. zolpidem). Additionally, the chart review attempted to identify the following: presence of random urine drug screens (UDS) within the past year, presence of controlled substance safety agreements (CSA), history of substance abuse, and history of suicidal ideation. Daily opioid doses were stratified into three main categories: greater than 100 mg morphine equivalents (ME), between 50-99 mg ME, and between 20-49 mg ME. Patients were further subdivided based on the presence of multiple BZD prescriptions within the specified time-frame. A secondary stratification occurred for patients receiving a BZD plus a z-hypnotic. Additional chart review information was tracked and documented for further assessment.

Results: The chart review identified 302 patients with active prescriptions for opioids plus BZDs over a 90 day time-frame. Two-hundred and fifty-six patients were identified to be on an opioid dose of at least 20 mg ME daily plus a BZD. Of the patients on at least 20 mg ME daily, 61 (24%) were on more than 100 mg ME daily, 80 (31%) were on 50-99 mg ME daily, and 115 (45%) were on 20-49 mg ME daily. In the 100 mg ME or greater group, 8 patients were on two

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BZDs and 13 were on a BZD plus a z-hypnotic. In the 50-99 mg ME daily group, 12 patients were on two BZDs and 17 were on a BZD plus a z-hypnotic. In the 20-49 mg ME daily group, five patients were on two BZDs and 20 were on a BZD and a z-hypnotic. The most commonly prescribed opioids were morphine, oxycodone, methadone, and fentanyl. The most commonly prescribed BZDs were clonazepam, lorazepam, temazepam, and diazepam. The most common indication for opioids was chronic back pain. The most common indication for BZDs was PTSD.

Conclusion: Concurrent use of opioids plus BZDs has been identified as a high a risk combination. Two-hundred and fifty-six patients were identified to take at least 20 mg ME daily and 10% of patients were taking more than one BZD. Based on the results of this project, education was provided on the risks of opioid plus BZD prescribing and improving utilization of UDS and CSA. Future objectives include reducing current prescribing of opioids plus BZDs, improving UDS and CSA utilization, and expanding educational efforts. A prior approval process to limit new starts of opioids plus BZDs was also implemented.

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Professional Poster Abstract

1-019

Category: Pain Management

Title: Reduction of high-dose opioid analgesic and oxycodone sustained-action utilization for chronic non-cancer pain through implementation of an opioid safety initiative

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Purpose: High-dose opioid analgesics, defined as greater than 200mg morphine equivalents (ME) daily, have been directly correlated with increasing rates of adverse events and unintentional overdose. Additionally, oxycodone sustained-action (SA) is one of the most heavily abused prescription medications in the United States. In terms of efficacy, high-dose opioid analgesics and oxycodone SA offer minimal benefit over moderate doses or other agents within the same class. The purpose of this quality improvement project was to implement an opioid safety initiative (OSI) to identify and reduce utilization of these high risk medications.

Methods: This quality improvement project was approved by the Pharmacy and Therapeutics Committee prior to commencement. All patients taking greater than 200mg ME daily and/or oxycodone SA for the treatment of chronic non-cancer pain (CNCP) were assessed for meeting chart review criteria. Patients were not included if they had active cancer or were receiving hospice/palliative care. The chart review focused on total daily ME, presence of a urine drug screen (UDS) within the past year, presence of a controlled substance safety agreement (CSA), and the number of patients who met their ME goal of less than or equal to 200mg daily. ME doses were stratified based on the following cut-offs: 201-400mg daily, 401-600 mg daily, 601-800mg daily, 801-1000mg daily, and greater than 1001mg daily. A daily ME trend, calculated by dividing the summed total daily ME (of all included patients) by the total number of patients, was used as a tool to identify overall trends within the OSI. Clinical Pharmacy Specialists (CPS), when consulted, assisted with high dose tapering, opioid conversions, and adjuvant therapy as appropriate. Active lists for all patients on greater than 200mg ME daily and/or oxycodone SA were given to providers quarterly.

Results: Fifty-six patients were identified to be on more than 200 mg ME daily in January 2013. The chart review identified 35 patients on 201-400mg, 12 on 401-600mg, 3 on 601-800mg, 4 on 801-1000mg, and 2 on more than 1001mg. Forty patients were identified to be on more than 200mg ME daily in April 2014. The chart review identified 29 patients on 201-400mg, 6 on 401-600mg, 3 on 601-800mg, 0 on 810-1000mg, and 2 on more than 1001mg daily. From the original 56 patients, 20 had met goal as of April 2014. Total daily ME for all included patients was 23,635mg in January 2013 and 16,611mg in April 2014 (~30% total ME dose reduction). Fifty-eight patients were on oxycodone SA in January 2013. Four patients remained for conversion in

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April 2014 which represents a 93% reduction in oxycodone SA utilization. Two patients (4%) had a UDS in the past year at the January 2013 review and 6 (15%) had a UDS within the past year at the April 2014 review. Eight patients (14%) had a CSA at the January 2013 review and 14 (35%) had a CSA at the April 2014 review.

Conclusion: The opioid safety initiative was created to increase patient safety by reducing the utilization of high-dose opioids and/or oxycodone SA. Significant progress has been made since the project was first initiated in 2013. Based on the results of this project, facility education regarding the safety of high-dose opioid analgesics is provided quarterly and to all new providers. Additionally, education focused on interpretation and improved utilization of UDS and CSA is provided for all healthcare staff. Non-pharmacologic modalities have also been expanded to improve the quality of care for all pain patients.

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Professional Poster Abstract

1-020

Category: Pharmacy Technicians

Title: Making history with pharmacy technicians: Development and implementation of an inpatient medication history process using the skills of pharmacy technicians

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Purpose: Obtaining accurate medication histories is critical for thorough medication reconciliation. While clinical pharmacists are highly qualified for completing medication histories, properly trained pharmacy technicians could also perform this task with quality and accuracy, thus freeing up pharmacist time for other clinical duties. With this in mind, efforts were made to redesign and streamline the current process for collecting inpatient medication histories and completing medication reconciliation, to encourage and enable all involved pharmacy employees to utilize skills at the top of their clinical skill set, and to maximize efficiency within the pharmacy service.

Methods: A pharmacy technician and clinical pharmacy specialist collaborated to develop a new process for collecting inpatient medication histories and subsequent medication reconciliation. Similar services offered at other facilities were reviewed, and programs which appeared to fit well were tailored to the needs of the service. The clinical pharmacy specialist oversaw training of the pharmacy technician in taking and documenting medication histories, which involved approximately 20 hours of observing clinical pharmacists conducting medication histories, and 20 hours of a clinical pharmacist observing the technician performing medication histories. Ongoing feedback for improvement, from both the pharmacist and technician perspective, was collected and disseminated on a continual basis. The clinical pharmacy specialist and pharmacy technician collaborated on designing a progress note for entry into the facility's electronic medical record. This progress note would be forwarded to the inpatient clinical pharmacists, who used the information to complete medication reconciliation, addressing discrepancies with the hospitalist. Tracking of time spent conducting medication histories, for both technicians and pharmacists, was also completed and used to estimate cost savings.

Results: Prior to implementation of this project, the average time for pharmacists to complete inpatient medication histories was 19.6 minutes, with a total cost of twenty-two dollars and two cents per history (wage of one dollar and twelve cents per minute). Once adequately trained, the average time for technicians to complete inpatient medication histories was 9.5 minutes, with a total cost of three dollars and ninety-nine cents per history (wage of forty-two cents per minute). With an estimated 685 inpatient admissions per year, the extrapolated yearly savings is twelve thousand, three hundred fifty dollars and fifty-five cents. Additional non-monetary benefits include time for more thorough medication reconciliation by clinical pharmacists, increased

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pharmacist availability for questions/consultation from other clinical inpatient staff, and greater job satisfaction from technicians.

Conclusion: Utilizing pharmacy technicians in the medication history process can result in more efficient completion of this critical task. Savings are noted in monetary and non-monetary terms, and employees respond positively to being tasked with duties at the upper end of their clinical skill set.

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Professional Poster Abstract

1-021

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of a redesigned approach to formulary management on resolution of medication-related issues in the outpatient setting

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Purpose: The Jesse Brown VA Medical Center provides care for over 40,000 veterans annually. Over one million prescriptions are dispensed to these veterans in the outpatient setting each year. Providing these medications to our veteran population in a safe and timely manner is of utmost importance. The medication-use system in the outpatient setting has become increasingly complex in recent years. Pharmacy service identified delays in timely resolution of many of these outpatient medication-related issues. This is concerning as timely response is imperative to providing optimal drug therapy in a safe and cost-effective manner.

Methods: Pharmacy service conducted a gap analysis of the delays in resolution of medication-related issues in the outpatient setting. It was determined that these delays were primarily related to increasing prescription turnaround times and confusion among pharmacy staff. Multiple factors were identified as contributing factors to delays in timely resolution of outpatient medication-related issues. These factors included (1) a rise in medication shortages, (2) an increase in medication recalls, (3) newly available drug safety information, (4) numerous local, regional, and national level cost-savings initiatives, and (5) communication. Two types of communication issues were identified as creating barriers to the outpatient formulary management process. This included both gaps and redundancies in communication. Gaps in communication often led to critical components of the medication use system being overlooked. This created a stressful and unsafe environment. Redundancies in communication resulted in significant amounts of time wasted due to re-work and decreased staff morale. Collectively, all of these barriers led to inefficiencies in the outpatient pharmacy setting. Ultimately, these barriers delayed patient care by causing increasing prescription turnaround times. Pharmacy service evaluated the results of the gap analysis and determined that all of these identified issues were in critical need of improvement.

Results: As a result of the gap analysis findings, pharmacy service developed an outpatient formulary committee. This committee consisted of the clinical pharmacy manager, outpatient pharmacy supervisors, pharmacoeconomics pharmacist, procurement pharmacist, and informatics pharmacist. A charter was developed that outlined the committee's purpose,

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responsibilities, scope, reporting relationship, and meeting frequency. The committee determined that a standardized process for handling medication-related issues was needed. This committee meets weekly and address issues related to medication shortages, recalls, formulary conversions, formulary status updates, informatics-related changes, cost-savings initiatives, and safety alerts. Further, the committee approved and utilizes several standardized checklists to ensure that all formulary-related issues are handled in a systematic and timely manner. Previously, resolution of these issues often took weeks or months to complete. After initiation of this committee and its weekly meetings, these issues are now resolved within days. Success of this committee was dependent on staff engagement and active participation. As a result of this committee and its weekly meetings, issues related to both gaps and redundancies in communication were resolved. Additionally, staff morale has increased tremendously due to the open communication. Most importantly, formation of this committee has led to timely resolution of medication-related issues in the outpatient setting.

Conclusion: An outpatient formulary management committee allows for improved communication and timely resolution of medication-related issues. This creates a safer environment and allows for provision of optimal drug therapy in a safe and cost-effective manner.

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Professional Poster Abstract

1-022

Category: Psychotherapy / Neurology

Title: Assessment of benzodiazepine utilization in post-traumatic stress disorder patients before and after pharmacist education in a rural veterans affairs mental health residential treatment program

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Michael Lemon

Purpose: Post-traumatic stress disorder (PTSD) is a common mental health disorder encountered in the Veterans Affairs (VA) healthcare setting. The VA/Department of Defense (DoD) PTSD treatment guidelines advise against the routine use of benzodiazepines (BZDs). BZD use concerns include adverse effects, potential for abuse and dependence, insufficient evidence of reducing PTSD symptoms, and worsening of PTSD symptoms upon discontinuation. This project's primary objective was to improve adherence to the VA/DoD PTSD treatment guidelines in regards to BZD utilization in patients admitted to a rural VA Mental Health Residential Rehabilitation Treatment Program (MH RRTP).

Methods: This quality improvement project was approved by the local Pharmacy and Therapeutics Committee. A pharmacist provided verbal and written education to MH RRTP staff and patients regarding BZD use in PTSD. Education was tailored to the audience and covered risks and benefits of BZDs, BZD dose reduction techniques and withdrawal symptoms. A list of MH RRTP patients with PTSD taking BZDs was given to primary care and mental health providers monthly. MH RRTP staff completed a questionnaire before and after pharmacist-led education to gauge changes in perception of BZD prescribing practices and BZD knowledge. A retrospective chart review was completed before and after pharmacist-led education to assess changes in BZD utilization. All patients enrolled in a MH RRTP between September 1, 2013 to October 31, 2013 and January 1, 2014 to February 28, 2014 were reviewed for PTSD diagnosis and BZD prescriptions. A more extensive chart review was completed on patients with a PTSD diagnosis and on a BZD. This review evaluated the use of pertinent psychiatric medications, diagnosis of certain psychiatric disorders, demographic data, BZD dose adjustments, and BZD withdrawal symptoms.

Results: The staff response rate for the questionnaire was 26 out of 41 for the pre-education questionnaire and 16 out of 41 for the post-education questionnaire. Prior to and after education, staff felt patients with PTSD would benefit from education about BZDs (73 percent strongly agreed and 27 percent agreed for both questionnaires). Prior to pharmacist-led education, BZDs were prescribed to 55 percent (17 out of 31) of patients with PTSD enrolled in a MH RRTP. Of those patients with PTSD, 30 percent were started on the BZD while enrolled in a MH RRTP and

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27 percent were continued on a BZD that was started prior to enrollment. After pharmacist education, BZDs were prescribed to 33 percent (17 out of 52) of patients with PTSD enrolled in a MH RRTP. Of those patients with PTSD, 8 percent were started on a BZD while enrolled and 25 percent were continued on a BZD started prior to enrollment. First-line PTSD treatment antidepressants, including selective serotonin reuptake inhibitors and serotonin and norepinephrine reuptake inhibitors, were prescribed to 53 percent of the patients with PTSD on BZDs prior to education. After education, 64 percent of patients with PTSD on BZDs were prescribed a first-line antidepressant.

Conclusion: The use of pharmacist-led education and monthly patient-specific BZD utilization lists increased adherence to the VA/DoD PTSD treatment guidelines. The use of BZDs in patients with PTSD in the MH RRTP appeared to decrease and fewer patients were initiated on BZDs. The questionnaire found staff felt education regarding BZDs would be beneficial to the patients and staff knowledge regarding BZDs appeared to improve. MH RRTP patients will continue to receive BZD education. Staff and provider education and lists of patients on BZDs with PTSD will be provided on an ad hoc basis if requested.

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1-023

Category: Quality Assurance / Medication Safety

Title: Impact of clinical pharmacists performing medication reconciliation on patient safety

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Purpose: The primary objective of this study was to trend the impact of clinical pharmacists performing medication reconciliation on patient safety at hospital admission and discharge over three time periods between 2006 and 2010. The secondary objective of this study was to determine the significance of errors prevented by clinical pharmacists.

Methods: This study was a retrospective quality assurance review approved by the institutional review board. A study population of patients requiring medication reconciliation by a clinical pharmacist at admission and discharge over three 3-month periods between 2006 and 2010 was determined. A database was used to identify patients who were admitted to and discharged from the same hospital between September 15, 2010 and December 15, 2010, September 15, 2008 and December 15, 2008 and September 15, 2006 and December 15, 2006. Medication discrepancies that resulted in a change, addition or deletion of a medication order were classified as a medication error. The number of medications ordered, number of medication errors prevented and % of orders with a prevented medication error during admission and discharge were collected. The types of prevented medication errors were aggregated into the following categories: incorrect drug, dosage or dosing interval errors, omission errors, duplication of therapy, allergy, drug-drug interactions, drug-disease interactions and other. Each prevented error was stratified to determine the significance of clinical pharmacist interventions. Serious errors were defined as having a higher potential for patient harm than significant errors.

Results: In 2010, over the 3-month period studied, clinical pharmacists prevented 660 medication errors during medication reconciliation. Of these errors, 159 were found at admission and 501 upon discharge. The severity of the prevented medication errors were mainly classified as significant but 19 admission and 77 discharge errors were serious. In 2008, over the 3-month period studied, clinical pharmacists prevented 323 medication errors during medication reconciliation. Of these errors, 99 were found at admission and 224 upon discharge. The severity of the prevented medication errors were mainly classified as significant but 7 admission and 24 discharge errors were serious. In 2006, over the 3-month period studied, clinical pharmacists prevented 510 medication errors during medication reconciliation. The severity of the prevented medication errors were mainly classified as significant but 12 admission and 51 discharge errors were serious. The most commonly prevented medication error for all 3 study periods was medication omissions with 64.7% in 2010, 50.2% in 2008 and 55.9% in 2006. The second most

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commonly prevented error was incorrect drug with 20.3% in 2010, 23.2% in 2008 and 20.2% in 2006.

Conclusion: Clinical pharmacists performing medication reconciliation have made a significant impact on accuracy and safety of medication prescribing during hospital admission and discharge. During the 3-month time periods in 2006, 2008 and 2010, a total of 1493 errors were prevented. Of the errors prevented, 1238 were classified as significant, 190 were classified as serious while only 65 were classified as minor. This study showed the errors prevented by pharmacists are primarily significant or serious and involve medication omissions and incorrect drugs. Clinical pharmacists had a significant impact in improving patient safety.

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Professional Poster Abstract

1-024

Category: Quality Assurance / Medication Safety

Title: Multidisciplinary approach in reducing medication errors with vaccinations and improving patient safety

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Purpose: Vaccinations are essential in reducing the risk of morbidity and mortality from preventable diseases and in protecting the public health from the spread of these diseases. Healthcare personnel, including pharmacists, play a crucial role in ensuring safe use of vaccinations. The institutions Medication Event Team discovered a pattern of vaccination related errors and decided to make this the focus of their annual aggregate review. The goal of this team was to implement a standardized and consistent approach to ordering, dispensing, administering and documenting adult vaccinations.

Methods: The Medication Event Team collected the total number of events that specifically involved vaccinations over a one year period. These medication events were reported via an anonymous electronic Patient Event Reporting (ePER) system. The team evaluated each of these vaccine events with the goal of determining the root cause for the pattern of errors. In an effort to improve the process and prevent future recurrences, a 90-day pilot study was developed and implemented in a specific outpatient clinic. One of the primary care nursing staff in this clinic was identified and trained as a vaccine super-user in order to simplify and standardize the vaccination process and facilitate appropriate ordering, dispensing, administering and documenting adult vaccines in the outpatient clinic. The super-user administered all vaccines and answered all questions and concerns regarding vaccinations. Pharmacy service audited all vaccinations during the pilot study to ensure that 95% of these vaccines were ordered, dispensed, administered and documented appropriately.

Results: A total of 44 vaccine related events were identified which attributed to 9.7% of all medication events during the one year aggregate review period. These vaccine-related errors included the administration of vaccines without an order, co-administration with a contraindicated medication, duplication of vaccine administration, administration of a wrong vaccine, improper documentation and administration to an immunosuppressed patient or to patients not meeting the usage criteria. The primary root cause for these types of medication events was that the variability and the lack of consistency in ordering, dispensing, administering and documenting vaccines contributed to the increased vaccine-related medication errors. Following the implementation of the 90-day pilot study and the audit of all vaccinations

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administered in the piloted outpatient clinic, it was determined that more than 95% of all vaccinations during the 90-day pilot study were ordered, dispensed, administered, and documented appropriately. Therefore, the number of vaccine related medication events in the piloted outpatient clinic area dramatically decreased. Due to the success of the pilot study, the model will be further expanded to other clinics.

Conclusion: By implementing a standardized and consistent process for ordering, dispensing, administering and documenting vaccinations, fewer medication events have been reported indicating improvement of patient safety.

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4-001

Category: Administrative Practice / Financial Management / Human Resources

Title: Activities and time commitments of clinical pharmacists in Qatar

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Purpose: The current documentation of clinical pharmacy activities conducted in hospitals is generally deficient, but still has been described widely in overseas countries. In Qatar however, like with the Middle East region in general, there is no description of these activities and/or resources required for delivering them. Clearly there is a need to address this lack of information in Qatar, together with addressing deficiencies observed with current documentation of clinical pharmacists activities. The study sought to quantify clinical pharmacists workload in Qatar, constituting the types of clinical pharmacy activities performed and the time needed to provide them to patients.

Methods: The study is prospective, observational and blinded, and was conducted the heart hospital (HH) and cancer hospital (CH) in Qatar, under the umbrella of the main health provider in Qatar, the Hamad Medical Corporation. Total of 9 clinical pharmacists participated in the study, which is > 80% of the clinical pharmacists available. Initially, observers recorded all types of activities by clinical pharmacists in all the hospital wards. The data collection software WorkStudy+ (Quetech Ltd., USA), utilizing hand-held smartphone devices, for pharmacists to use to record data on a defined range of activities they provided as they spent their working days, was pilot tested for one-month duration for the purpose of the study settings. The long-term actual data collection was then conducted in 2013 on daily basis for as long as six-month duration. Computer database linked to the study hospitals stored/classified the data according to the ICD (International Classification of Disease) for treated patients. All time data was generated via the used software, with desired 95% confidence level and a standard error of 5%. Outliers were excluded from analysis. The project obtained the required ethics approvals by all collaborating institutions.

Results: Observations recorded 32 separate types of activities, which exceeds the number of activities reported in literature for overseas practices. Clinical pharmacists conducted a total of 57,547 and 47,794 minutes of activities in HH and CH, respectively, representing 1,245 activities in the former, and 703 activities in latter. In average, these calculate 9.8 and 8.4 hours of workload per day, respectively. In HH, clinical rounds activities were the most observed activities (n=205), followed by medication reconciliation. In CH, administrative activities counted most (n=114), followed by the clinical rounds. The average time required by

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pharmacists was successfully documented for each of the activities, with standard deviations ranging from 2-3.9 minutes. For an activity, different time was required for different types of patients in the same setting. The time required to complete medication history interview and medication reconciliation was consistent with that in overseas practices. However, for the interventions, clinical review of medical records, and medication order review, the time required was less than that reported by overseas practices. Surprisingly, the administrative activities in Qatar was three folds that reported in international literature, mainly due to the research activities involved, which added to 86 minutes a day.

Conclusion: There is no generally accepted method for documenting activities of clinical pharmacists. But methods used in the current study seem to be reflective and efficient. The number of clinical pharmacy activities in Qatar exceeds that reported by overseas practices, especially in relation to management and research type of duties. In a single general inpatient population, the ICD category of disease demands a different level of workload invested as compared to other disease categories. Results are valuable for hospital administrators in projecting pharmacy resources in different settings, especially in relation to what site or patient type requires more/less manpower support.

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4-002

Category: Administrative Practice / Financial Management / Human Resources

Title: Use of the Office of Inspector General (OIG) workplan by a community hospital pharmacy services department as a risk assessment tool

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Purpose: Risk assessment and mitigation are ongoing management activities. A source of potential risks is outlined in the Office of Inspector General (OIG) workplan. This workplan summarizes the activities the OIG plans to pursue to protect the integrity of Health and Human Services programs and the well-being of beneficiaries by detecting and preventing fraud, waste, and abuse. This report describes the use of the OIG workplan in a collaborative between pharmacy services and compliance departments in a community hospital to identify potential risks associated with medication billing and operations.

Methods: Annually, the OIG publishes a workplan. Shortly after its publication, the director of pharmacy and the pharmacists involved in medication billing and charge master maintenance meet to review the workplan for potential risks within our organization. The hospital compliance coordinator is invited to the meetings for additional expertise in assessing risk. After reviewing each OIG-planned medication-related activity, the pharmacists work with the hospital patient financial services and impacted departments to assess risk and implement mitigation action plans.

Results: Annually, pharmacy services provides a report of the risk assessment and mitigation activities to the hospital compliance department and hospital administration. Inclusion of the hospital compliance coordinator provides an additional perspective and resources to the assessment and helps to formalize the process. This process and report are recognized as valuable management activities during routine business reviews with administration.

Conclusion: Joint formal review by pharmacy services and compliance departments of planned medication-related activities in the annual OIG workplan is a worthwhile risk assessment activity.

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4-003

Category: Administrative Practice / Financial Management / Human Resources

Title: Cost savings associated with insourcing of compounded sterile preparations

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Purpose: As hospitals continue to face financial challenges, it is imperative that pharmacy management scrutinize the budget for cost savings opportunities without compromising quality of care or negatively impacting operations.

Methods: Examining our budget revealed much opportunity to reduce the annual spend on outsourced sterile preparations. This line item was responsible for approximately \$360,000 for fiscal year 2013 and was a result of outsourcing eight different medications. After analyzing cost to prepare and accounting for variables such as wastage and additional staff, pharmacy administration proposed a plan to hospital financial leaders that would result in an estimated net savings of \$100,000. An FTE technician needed to be added not only to prepare the additional 500 estimated preparations per week, but to also aggressively rotate stock in, out, and between automated dispensing cabinets to minimize waste. After obtaining approval from the C-Suite, the program began in November of 2013

Results: Between November 2013 and May 2014, insourcing of certain compounded sterile preparations yielded a documented net savings of \$84,200. Annualized, this results in excess of \$144,000.

Conclusion: Insourcing of compounded sterile preparations resulted in significant cost savings to our 400 bed community hospital.

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4-004

Category: Administrative Practice / Financial Management / Human Resources

Title: Early identification of financial opportunities through monthly variance analysis

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Purpose: In the ever-tightening financial picture facing hospitals, much focus is placed on containing costs, with pharmaceuticals being one of the largest buckets. With the constantly changing pressures of drug shortages, changes in acquisition costs, and unique patient needs, budgets can vary greatly. In a large, tertiary care hospital, the analysis of monthly variance reports has helped identify potential opportunities, allowing the issues to be addressed in a timely manner and preventing a significant impact on the pharmaceutical budget.

Methods: On a monthly basis a variance report is put together, identifying significant changes in purchases as compared to a previous 12 month average. For drugs with significant variances, a further analysis is done to identify the potential cause. The analysis typically includes a purchase and cost analysis and drug use evaluations. Opportunities for improvement are identified. These variances are discussed with hospital leadership and action plans developed. Purchases are then tracked to monitor the success of initiatives.

Results: Since beginning the reporting in May 2013, a total of 77 variances have been identified. These variances can generally be grouped into four categories: variance in cost, increase in use, drug shortages, and deviation from drug use policy. A variety of initiatives have resulted from the variance analyses. A product selection change from potassium chloride oral powder to liquid, will save an estimated \$125,000 per year. An operational initiative to address a collagenase variance resulted in removal from automated dispensing cabinets and removal of errant order sentences from the CPOE system. This has encouraged appropriate use and \$70,000 per year in savings. An example of a drug policy change is the preferential use of sildenafil over tadalafil for inpatients, which resulted in a savings of \$40,000. Intravenous ethacrynic acid was another example in which an IV-to-po therapeutic interchange coupled with education has created in nearly a \$70,000 savings. Discussing the variance report on a routine basis with senior hospital leadership is imperative in the success of these initiatives, as they can help garner interdisciplinary buy-in. Also, the variance reporting has helped to highlight that the pharmaceutical expense can often be out of the hands of the pharmacy.

Conclusion: Variance analysis has resulted in significant cost savings to this large, tertiary care hospital. Conducting the analysis on a monthly basis has also allowed for quick identification of

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issues with a more rapid development of solutions. Routine discussion with hospital leadership has helped garner support for resulting initiatives.

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4-006

Category: Administrative Practice / Financial Management / Human Resources

Title: Educational value of pharmaceutical company-sponsored dinners to professional students

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Purpose: Pharmaceutical companies often host speakers to educate healthcare professionals over lunch or dinner, incentivizing individuals to come for continuing education (CE) credit and a free meal. Up to 60% of accredited CE programs are funded by pharmaceutical companies as commercial support often increases the quality of educational programs. While data suggest that physicians' prescribing practices are influenced by sponsored talks, no assessments have evaluated how effective these educational meals are in informing pharmacy students about medications and the diseases they treat. The purpose of this study is to determine whether pharmacy students gained knowledge from pharmaceutical industry-sponsored education programs.

Methods: First to fourth year pharmacy students that were members of the Asian Pharmacists' Association (APA) were invited to attend two lectures discussing hepatitis B (HBV) and hepatitis C (HCV). The dinners were organized as part of APA's Hepatitis Initiative to promote awareness and education amongst Asian Americans, a high-risk group for hepatitis. A pre-lecture survey on viral hepatitis was given to participants before the dinner presentation. Demographic information including race, gender, age, and year in school was collected. A five-point Likert scale and basic true/false questions assessed the students baseline knowledge. After the lecture, the same survey was provided with the addition of a free response section which asked for three facts they learned from the presentation. The responses were documented in Excel. The answers were collected to assess the students' scores before and after the dinner. A statistical analysis of the results was performed through a paired t-test.

Results: Attendees included females (62%, 71%), Asians (87%, 97%), and more first- and second-year pharmacy students (67.7%, 74.7%) than third- and fourth-year students (32.3%, 25.3%) for the HBV and HCV program, respectively. The pre-survey showed students understood some basic facts about HBV: HBV is common in Asia (100%), can be spread through blood transfusions, tattoos, and piercings (100%), and vaccines are commercially available (93.3%). However, students failed to understand its effect on the liver with 46.7% incorrectly believing that HBV eventually leads to liver transplantation and 33.3% incorrectly answering that most people will develop liver cancer. However, after the dinner presentation, 75% responded correctly to both questions. Students answered a greater percentage of HBV survey questions correctly, from 85.2% pre-survey to 89.5% post-survey, which was statistically

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significant ($p=0.024$). The baseline pre-HCV survey score was 81.8%, compared to 92.3% post-survey ($p=0.0008$). The students' understanding of HCV leading to cirrhosis within the first 20 year following transmission was statistically significant, $p<0.05$ between the pre and post HCV surveys. More importantly, students learned that a cure exists for HCV, from 39% on the pre-survey to 94.7% on the post-survey ($p<0.05$).

Conclusion: Pharmacy students improved their factual knowledge about viral hepatitis after attending pharmaceutical company-sponsored dinner lectures. Whether students chose to attend for their own education or to enjoy a complimentary meal, they learned practical knowledge for their field of work. Pharmaceutical company-sponsored educational programs are effective in educating participants and provide positive value. Participation in these dinners may serve as a useful supplementary means of education.

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4-007

Category: Administrative Practice / Financial Management / Human Resources

Title: Development of a health information and clinical outcomes fellowship

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Purpose: Post graduate residency and fellowship programs are becoming a common pathway for pharmacy students. An area of focus for these types of programs has primarily been within the hospital practice side of pharmacy. A need was identified to develop a fellowship program within an industry practice setting. The fellowship development processes and outline of objectives can provide guidance for future industry programs.

Methods: A team was formed to develop a two-year fellowship program that focused on health information and clinical outcomes. The purpose of this program was identified to train pharmacists in the area of health information management solutions and associated clinical outcomes related to regulatory, quality, safety, and accreditation standards. The fellow will obtain industry related experience with clinical services, medical content development, marketing, sales, client support, and software development of clinically relevant solutions to meet the growing challenges in healthcare. The fellowship training program focuses on several key clinical areas including medication management, anticoagulation, antimicrobial stewardship, healthcare quality, infection prevention, and sepsis management. During the two years the fellow will receive hospital practice experience facilitated by a partnering health system and pharmacy industry experience focused on clinical technology solutions.

Results: The team finalized development of the fellowship program and identified objectives for the pharmacy industry experience. The objectives, focused on clinical technology solutions, were as follows: 1) demonstrate a basic knowledge of research techniques and ability to apply them to research projects focused on improving medication safety and patient outcomes 2) participate in ongoing research studies that relate to clinical technology solutions 3) evaluate drug literature in an effort to make clinical conclusions based on evidence-based medicine 4) describe healthcare regulations, standards, and goals associated with quality and patient safety 5) incorporate informatics strategies and principals 6) explain pragmatic marketing and develop clinical white papers 7) explain agile methodology and apply clinical expertise to the product development process. The fellow will also be responsible for designing a research proposal, conducting the research, analyzing data and preparing and submitting presentation of work at professional or scientific meetings.

Conclusion: The development of a fellowship program focused on health information and clinical outcomes provides a unique experience to the post graduate program landscape.

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4-008

Category: Administrative Practice / Financial Management / Human Resources

Title: Health system pharmacy and therapeutics committee integration and formulary alignment: successes challenges and everything in between

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Purpose: The escalating costs of medication therapy in an era of declining reimbursement make effective formulary management a focus for essentially every organization. The increased rate of consolidation and system integration occurring in the health system arena has made health system formulary alignment an issue facing many organizations. An academic medical center and two community hospitals in Wisconsin came together recently under a health system umbrella. Each entity had its own medication formulary and Pharmacy & Therapeutics (P&T) committee. The P&T committee and formulary disparities were identified as key organizational opportunities for driving standardization and alignment. The objective of this presentation is to describe the health system P&T integration and formulary alignment undertaken, including the successes, challenges and other lessons learned.

Methods: The health system felt P&T committee restructuring was essential if formulary alignment and ongoing formulary management were going to be successful. The organization committed to integrating the P&T structure by making necessary structural and functional changes over a 2-year time frame. The only predetermined direction was development of a single health system P&T committee for formulary management - System P&T. Formulary alignment was the first task for the System P&T. The committee approached this effort by forming a Medication Use Advisory Group, comprised of pharmacists from each of three institutions. The committee divided the formulary into 92 medication classes based on AHFS classifications. A gap analysis was performed for the medication detail within each class, comparing the medication formulary for that class across all three sites. Individual members of the advisory group, as well as residents and staff pharmacists were engaged in evaluating the classes. The identified discrepancies and recommendations for alignment were subsequently vetted through an organized approval pathway of the Medication Use Advisory Group, an array of clinical and operational stakeholders, and subsequently the System P&T.

Results: The health system initially developed the System P&T as a steering group that attempted to get each site P&T working toward formulary alignment and kept the authority for formulary management at the site level. The site-based decision model resulted in divergent decision-making and operational challenges. Subsequently, the organization made functional

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changes, giving System P&T the formulary gatekeeping authority and shifting the site P&T foci to implementation and utilization management. The structural changes that were made to support these efforts included populating the committee with the chief medical officers and P&T chairs from each hospital site, and moving the robust subcommittee structure from the academic site under System P&T. Formulary alignment evaluation, recommendations for alignment and P&T voting occurred over an 18 month interval. Over 5,800 medication line items were evaluated across all three sites. Operational roll-out required an additional six months. The process resulted in over \$330,000 in medication cost savings. The primary drivers were standardization of low molecular weight heparin products, vaccines, atypical antipsychotics, and ophthalmics. A number of unique, small savings opportunities (termed Hidden Gems) were also identified and implemented. The most challenging scenarios involved products with significant patient safety concerns, including insulins, promethazine and intravenous infusion concentrations.

Conclusion: The integration of the P&T structure and formulary alignment across the health system took substantial time and energy, but it has resulted in more streamlined and efficient decision-making, improved site focus on utilization, enhanced product and practice standardization, and substantial cost savings.

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4-010

Category: Administrative Practice / Financial Management / Human Resources

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 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 33 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. Statistical analysis was conducted through a paired sample t-test. Internal review board approval was not required.

Results: Eight students enrolled in the fall 2013 course and all completed the survey. Following the completion of the course, students reported that they felt more familiar with the residency application process (95 percent CI, -2.714 percent to -0.536 percent, p equals 0.010), more prepared to apply for a residency (95 percent CI, -1.894 percent to -0.106 percent, p equals 0.033), and navigating PhORCAS (Pharmacy Online Residency Centralized Application Service) (95 percent CI, -2.991 percent to -1.509 percent, p less than 0.001). Although not statistically significant, students were less apprehensive about interviewing for residency positions, their personal competitiveness and successfully matching with their chosen program. With regards to conducting research, students were less apprehensive about the IRB approval process and collecting data, however these findings were not statistically significant.

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.

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Students are also less apprehensive about conducting research. While many of the results are not statistically significant it is likely due to the small number of students enrolled. As postgraduate training continues to gain momentum, preparing students for these coveted positions is essential.

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4-011

Category: Administrative Practice / Financial Management / Human Resources

Title: Economic impact of a patient assistance program in an academic medical center

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Purpose: Hospitals are finding it increasingly challenging to recoup some of the financial losses they sustain when providing care for the uninsured and underinsured. Patient Assistant Programs (PAPs), sponsored by pharmaceutical and medical-device manufacturers, help hospitals recoup some of these losses by replacing the medication or medical device administered or dispensed to an indigent patient. Managing and maintaining a successful recovery program requires a hospital patient assistant coordinator to stay current with over 400 manufacturer programs, to adapt rapidly to changing regulations and enrollment processes, and to have impeccable record keeping and patient advocacy skills.

Methods: Identify drugs and medical devices purchased by the hospital that will qualify for PAP recovery opportunities. Savings were quantified using the hospitals acquisition cost at the time of product recovery for the quantity of product received. The hospital pharmacy and billing records were used to collect patient qualifying criteria such as drug administration, drug flow sheets, patient demographics, patient income verification, patient signatures, federal tax returns, wage and tax statements (W2), and disability benefit verification statement. Enrollment forms were then submitted via fax or mail as required by the PAP program. Products recovered were documented and audited for correct medication and quantity received. A daily census report was created to identify indigent patients who were administered the targeted medication or medical device. Savings were tracked on a weekly and basis for all received medications and devices.

Results: A 969 bed academic medical center recovered at total of \$960,104 versus a target of \$947,887 from August 2012 to December 2013. The program continues to expand and assist patients with home maintenance medications and also recovers some medical devices for the institution.

Conclusion: This academic medical center successfully implemented and quantified a Patient Assistant Program that helped recoup pharmaceuticals for the hospital and assisted patients with obtaining needed medications. It is recommended that other institutions implement these PAP initiatives.

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4-012

Category: Administrative practice / Financial Management / Human Resources

Title: Pharmacist-led comprehensive discharge programs: The effects on medication errors, patient satisfaction, and readmission rates

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Purpose: Decentralized pharmacists at a community teaching hospital have been practicing a variety of individualized medication education techniques for over a year. With the implementation of value-based purchasing in 2013, and in order to re-align our services with the Pharmacy Practice Model Initiative Summit, a change, and standardization in the decentralized practices was vital. This case describes the implementation of this new process and how this new process impacted medication errors, Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores, and readmission rates.

Methods: A pharmacy shared governance committee was implemented at a community teaching hospital. This committee was charged with developing a practice model that promoted patient focused pharmacy practice across the continuum of care. The result was a comprehensive discharge program, which included discharge medication reconciliation by a pharmacist, disease state counseling, and medication education for all home-going medications. This service was provided on four nursing units to all patients being discharged home, or to a rehabilitation center. Pharmacists documented each patient encounter in the electronic medical record as well as the pharmacy's productivity system. This documentation was retrospectively analyzed to determine the number, and types of medication errors detected during the eight month study period. Readmission rates and HCAHPS scores for this time period were also reviewed. These results were compared to the eight month time period one year prior.

Results: Pharmacists piloted the comprehensive discharge program from August, 2013 through March, 2014. During this time, pharmacist-to-patient encounters significantly increased. There was approximately a 53% increase in patient education encounters, and almost a nine-fold increase in the number of medication reconciliations performed. Four thousand one hundred twelve total medication errors were detected and modified by pharmacists prior to the patients discharge. Medication errors were classified into one of five categories (incorrect drug, dose, or frequency; initiation of therapy, or discontinuation of therapy). Thirty-one percent of errors were classified as incorrect frequencies, making this the most prevalent of the five classifications. There was no effect on readmission rates or elements of the HCAHPS survey during the eight-month pilot.

Conclusion: Pharmacist-led discharge programs increase the number of pharmacist-to-patient encounters, and are useful in detecting medication errors at discharge. This program had no effect on HCAHPS scores, affirming that a collaborative approach from the interprofessional team is required to impact survey results. Readmission rates may not have been affected because

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this service was provided to all patients as opposed to targeting only high-risk patients. Plans have been implemented to strengthen the interprofessional team.

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4-013

Category: Ambulatory Care

Title: Impact of pharmacist counseling on patient's acetylsalicylic acid knowledge

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Purpose: Diseases of the circulatory system represent a major cause of mortality in Lebanon. The high prevalence of cardiovascular disease (CVD) is not a surprise since Lebanese are known to have multiple risk factors. Antiplatelet therapy has been shown to reduce the risk of vascular events where acetylsalicylic acid is the most commonly used drug in Lebanon. Given the magnitude of the CVD problem, patient education about major areas regarding acetylsalicylic acid will lead to substantial improvement in healthcare outcomes. The purpose of the study is to evaluate Lebanese patients' knowledge about acetylsalicylic acid before and after the community pharmacist counseling.

Methods: The institutional review board approved this interventional prospective study conducted in February 2014 at nine different community pharmacies around Lebanon. An informed consent was obtained from the enrolled participants. A total of 97 patients were studied based on the eligibility criteria which included participants aged 40 to 79 years and resided in Lebanon at the time of the survey. A face to face interview using a questionnaire was carried out to assess and record patients' baseline acetylsalicylic acid knowledge about its indications, administration, side effects, contraindications, and precautions. Then patients were counseled regarding the different aspects of acetylsalicylic acid use, and provided with an informative pamphlet. After intervention, knowledge scores were measured using the same practice questionnaire. Effectiveness of counseling was evaluated by comparing the mean knowledge scores before and after counseling using paired sample T-test.

Results: A total of 97 patients were enrolled with a mean age of 53.11 years, and the number of participants is evenly distributed between genders (53.6 percent are men). Seventeen percent live in rural areas and 83 percent live in urban areas. The mean knowledge scores before counseling for acetylsalicylic acid indications, administration, side effects, contraindications, and precautions are 1.36, 3.59, 0.88, 0.56, and 0.84, respectively. These scores are changed to 2.52 (P less than 0.0001), 6.60 (P less than 0.0001), 3.07 (P less than 0.0001), 2.23 (P less than 0.0001), and 2.36 (P less than 0.0001), respectively, after counseling.

Conclusion: There was a statistically significant difference between all knowledge scores before and after the pharmacist counseling. The study demonstrates the effectiveness of pharmacists counseling in increasing the awareness of acetylsalicylic acid knowledge and its place in CVD prevention. This assures the important role and the great impact of pharmacists in improving

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health care outcomes by raising patient's knowledge. Such efforts should be implemented on a more regular and widespread basis, and should be combined with other approaches involving the emphasis of screening people between 40 to 79 years for the 10-year atherosclerotic CVD (ASCVD) risk.

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Professional Poster Abstract

4-014

Category: Ambulatory Care

Title: Knowledge about Diabetes medications and its association with glycemic control among adults with type 2 diabetes in Qatar

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Purpose: Diabetes education is considered an integral part in the management of diabetes. Previous studies in Qatar revealed variable levels of patients' knowledge about diabetes between ambulatory and hospital settings. However, these studies evaluated overall knowledge and did not correlate it with clinically important outcomes. The aim of this study is to assess the level of knowledge about diabetes medications, specifically, and its correlation with glycemic control in adult patients with type 2 diabetes attending ambulatory and hospital based diabetes clinics in Qatar.

Methods: Patients diabetes medications were identified by electronic chart review, and their knowledge about these medications (oral agents and/or insulin) was assessed by an interview-based questionnaire derived from the National Council on Patient Information and Education's (NCPPIE) consumer guide and validated in previous literature. Areas assessed pertained to: medications name (generic or brand name), mode of action, administration, important side effects and how to react if they occur, and finally what to do if a dose is missed. Patients were divided into three groups based on their type of therapy: oral medications, insulin and combination therapy. A maximum knowledge score of 8, 7 and 15 was assigned for each group, respectively. Subsequently, knowledge scores were correlated to the most recent HbA1c (drawn within the previous 90 days before enrollment). Potential confounders of knowledge scores and glycemic control, such as type of therapy; number of diabetes medications; level of education and previous receipt of education about diabetes therapy were further evaluated by multivariate logistic regression analysis. All data were analyzed using the Statistical Package for the Social Sciences (SPSS) 18.

Results: Of the 250 evaluated patients, 59.6% were on oral hypoglycemic agents alone, 7.6% were on insulin and 32.8 % received a combination of both. Only 56% of patients reported receiving education about their diabetes medications; which was provided by the treating physician in 50.7% of cases. The majority of patients did not achieve the ADA target HbA1c of < 7 (71.2%). Mean knowledge score(+/-SD)was(5.2 +/- 0.9) for oral hypoglycemic agents,(5.3 +/- 1.3) for insulin and(10.4 +/- 2.1)for combination therapy. Patients scored highest in their knowledge of how and when to take their medications and lowest in their knowledge of oral medications' side effects and insulins' mode of action (onset and duration). Pearson correlation and multivariable logistic regression analysis showed insignificant association between

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knowledge scores and glycemic control in the three evaluated subgroups of patients, after adjusting for all possible confounders. Educational level and previous medication counseling were the only significant variables associated with high knowledge scores (> 5) in patients receiving oral agents. Moreover, type of therapy (insulin alone; combination therapy) and number of prescribed medications (3 medications or more) were the only significant predictors of poor glycemic control.

Conclusion: Among adults with type 2 diabetes in Qatar, an overall good knowledge about diabetes medications was observed. However, this knowledge did not correlate with glycemic control. Further studies are needed to explore factors other than knowledge that may play a role in the effect of diabetes education on glycemic control, such as motivational interviewing, follow up frequency and drug therapy optimization.

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4-015

Category: Ambulatory Care

Title: Strategies for improving medication adherence in multiple sclerosis patients: the role of a multidisciplinary team

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Purpose: Research in patients with multiple sclerosis (MS) has shown that higher rates of adherence are linked to a lower risk of severe relapse. To promote adherence, interventions need to incorporate new and creative approaches. Our group validated in a previous research the good correlation between direct and indirect methods to measure rates of adherence. In this study we evaluated SM patient adherence to three drugs with different frequency and route of administration. The influence of proactive interventions from a health-care team was also appraised.

Methods: Three different drugs were selected: interferon beta 1-a which is administered by intramuscular injection once a week; interferon beta 1-b which is injected subcutaneously every other day and fingolimod that is taken once a day by mouth. Patients with MS receiving selected drugs from the pharmacy department during the last 12 months were included. Patients with treatment interruptions for any reasons were excluded. A proactive approach was taken to facilitate the adherence. A neurologist informed to the patient at the beginning of the treatment and visited him every 3 months. A nurse provided education on the different devices, the technique of administration and gave advices about care and risk prevention related to drug administration. A pharmacist dispensed monthly the necessary amount of drugs, explained possible side effects and drug interactions and checked in every visit any problem with the adherence, especially if a gap or a delay during the follow-up was detected. Using the dispensing records, adherence was calculated by an indirect method as dispensed units/needed units x 100.

Results: Sixty-four patients were dispensed any of selected drug during the last year. Four patients were excluded from the adherence calculation: 2 pregnant women during the study period, 1 case of hepatitis and the last one admitted to hospital for one month. The average adherence rate was over 95% independent on the drug received. In patients treated with interferon beta-1a the adherence reached 99% being 100% in all patients using the pre-filled pen. Five patients had an adherence rate less than 95% and two of them (3% of the total) were between 80 and 90%. The relationship and communication among physicians, nurses and pharmacists reinforcing the same message to the patient was considered the main factor contributing to these results.

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Conclusion: In our cohort of patients with MS the adherence rate reached almost 100%. Assessing patient needs and lifestyle is essential to improve the adherence. In this sense, a multidisciplinary team including neurologists, nurses and pharmacists providing education, motivation and support to patients and families had a very great impact on adherence.

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4-016

Category: Ambulatory Care

Title: Impact of a clinical pharmacist-run medication reconciliation telephone service for new patients entering a primary care practice

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Purpose: A clinical pharmacist (CP) performing medication reconciliation helps in identifying medication-related issues that will improve a patients quality of care. The purpose of this study is to determine the impact of implementing a service in which a CP contacts patients new to an Atrius Health primary care practice via telephone and documents an accurate medication list, identifies medication-related issues, drug cost-saving opportunities, and screens for medication non-adherence. Any medication-related recommendation provided by the CP will be available to the primary care physician (PCP) prior to the patients first upcoming primary care practice appointment.

Methods: The Institutional Review Board approved this prospective observational study. Subjects included new patients aged 50 or older who were assigned a PCP at the Wellesley, MA site. Control subjects were selected by applying the aforementioned inclusion criteria to patients who joined the practice from July 2013 to May 2014. The CP called study subjects to obtain a current medication list, to identify medication issues, and provide recommendations which were documented in the patients electronic medical record. Recommendations were sent electronically to the PCP before the patients first appointment. In the controls, the primary investigator identified medication issues addressed by the PCP in the patients first appointment. Assuming that 75 percent of recommendations will be accepted in the study group and 50 percent in the control group, 64 recommendations are required to detect a 25 percent difference at the 5 percent level of significance with 80 percent power. The primary outcome included the percentage of CP provided medication recommendations acted upon by clinicians during the patients first visit in the study group, compared to the number of medication issues addressed by clinicians during the patients first visit in the control group. Secondary outcomes included clinician satisfaction and a financial return-on-investment assessment.

Results: There was a statistically significant difference in the percentage of CP provided recommendations that were acted upon by the clinician in the study group versus the percentage of medication issues addressed by the clinician during the patients first visit in the control group, 42 percent versus 15 percent respectively (P equals 0.001). The majority of recommendations made in each group were categorized as cost saving recommendations, 68 percent versus 52 percent (P equals 0.046) in the study versus control group respectively. Of these cost saving recommendations, 46 percent were accepted in the study group versus 22 percent in the control group (P equals 0.026). Seventy seven percent of clinicians found the service was beneficial and

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saved them time; 85 percent felt the service helped to optimize patients medication regimens. For approximately every seven dollars the organization saved from the acceptance of a cost saving recommendation, one dollar went towards the cost of having a pharmacist perform the service; this yielded a net profit of six dollars. All baseline characteristics were similar except age in which the control group was significantly older than the study group [(58.6 plus or minus 13.4 versus 53.7 plus or minus 11.7), P equals 0.006] respectively.

Conclusion: Having a CP perform medication reconciliation prior to patients entering a new primary care practice resulted in the identification of more medication recommendations and a statistically significant higher percentage of medication issues being acted upon versus having the clinician perform medication reconciliation without the assistance of a CP. The majority of recommendations identified were associated with saving the organization money. Because the service was well received by clinicians and there was a positive return on investment, it was determined that Medication Onboarding will be implemented at other Atrius sites. Future studies should interpret cost analyses over a longer time period.

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4-017

Category: Ambulatory Care

Title: An educational intervention study evaluating a pharmacist-directed skin screening program

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Purpose: Skin cancer is the most prevalent form of cancer in the United States and the incidence continues to increase. Actinic keratosis is the most common precancerous condition with over one-half of the adult population reporting having a sunburn in the last 12 months. Over 90% of nonmelanoma skin cancers are caused by UV exposure. Prevention and education are key factors in modifying this risk. The purpose was to have pharmacy screen patients to educate them on their specific risks of sun damage, as well as proper prevention strategies to limit damage, and in turn, decrease the incidence of skin cancer.

Methods: The Institutional Review Board approved this screening and educational intervention study as part of an employer-based wellness program. An announcement went to all employees asking for participation in the study. Eighty patients volunteered and were screened by pharmacists and student pharmacists with the Skin Scope FS 112-P (Ikonna). The skin scope machine uses a black light to show dry skin, dead skin, oily skin, thin skin, and hyperpigmentation of the skin of the face. Student pharmacists performed the skin scope and charted any abnormalities on a blank face form designed by the team. Each patients results were discussed with them and education was provided. All patients were counseled on skin protection, however based on the severity of their sun damage, some patients were referred to a dermatologist. Educational materials (available on the employer website) were designed by the pharmacy and were provided for patients to take home. The results of the screening were placed in a confidential database and analyzed using descriptive statistics. The primary outcome variables were the number of referrals and severity of damage. Additional variables included age, gender, sun-sensitizing medication, and number of hours in the sun per week in summer and winter.

Results: Eighty patients signed the informed consent and fully participated in the study. The skin scope screening took an average of 3 minutes to perform with an average time to counsel a patient of 3 to 5 minutes. Females represented 82.5% of the study with the average age being 44.7 years. Ten percent reported being on a sun-sensitizing medication. Of the patients examined, 43.75% were referred to a dermatologist based on severity of damage noted on the skin scope results and/or a strong family history of skin cancer. The severity index was based on a 5-point scale with 1 representing mild damage, 3 representing moderate damage and 5 representing severe damage. The average severity score of those patients referred to a

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dermatologist was 1.8 representing mild to moderate severity. Eight patient (10%) scored moderate to severe damage. The average number of hours in the sun during the summer was 16.3 hours per week while the average for the winter was 5.6 hours.

Conclusion: Pharmacists and student pharmacists can play a critical role in educating and screening patients for the most common type of cancer. The skin scope is useful in helping patients understand the consequences of sun exposure. This study demonstrated that a high percentage of patients would benefit from a referral to a dermatologist. Evidence suggests that early detection is a critical component in reducing the risk of advanced skin cancers. Pharmacists are in an ideal setting to counsel patients on proper skin care including prevention with sunscreen and sun-sensitizing medications. This program can easily be duplicated in any ambulatory pharmacy setting.

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4-018

Category: Ambulatory Care

Title: Evaluation of influenza and pneumococcal immunization rates in a family medicine center

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Purpose: Influenza and pneumococcal vaccinations are especially recommended for those age 65 years and older who are considered persons of higher risk. According to the Centers for Disease Control and Research, an early estimate showed that only 61.8% of people 65 years and older received the influenza vaccine during the 2013-2014 flu season. Sixty percent of those 65 years and older have been immunized against pneumococcus. Factors contributing to low vaccination rates are misconceptions and inordinate concerns about adverse drug reactions. The objective of this study was to evaluate influenza and pneumococcal immunization rates in patients 65 years and older.

Methods: This was a retrospective, single-center study. Patients 65 years and older who received influenza or pneumococcal immunizations at Overlook Family Medicine between October 2011 to March 2012, October 2013 to March 2013, and October 2013-December 2013 were evaluated. The total number of patients 65 years and older seen at Overlook Family Medicine during the defined study periods was also evaluated. Data was collected utilizing Business Objects software, which identified patients with procedural vaccination codes. Influenza and pneumococcal immunization rates were calculated utilizing the data obtained. The percentage of Overlook Family Medicine patients 65 years and older with an admission diagnosis of pneumonia at Overlook Medical Center was calculated by evaluating inpatient admission data tracked at Overlook Family Medicine.

Results: A total of 407 patients 65 years and older were seen at Overlook Family Medicine during the defined study periods. Influenza immunization rates during October 2011 to March 2012, October 2012 to March 2013, and October 2013 to December 2013 were 30%, 39%, and 40% respectively. Pneumococcal immunization rates were 8%, 10.5%, and 27% respectively. The percentage of Overlook Family Medicine patients 65 years and older with admission diagnoses of pneumonia during the defined study periods was 3.2% (13/407). Study limitations were that the percentage of patients who were vaccinated in other settings was not available, and only patients with an admission diagnosis of pneumonia were evaluated.

Conclusion: This study illustrated that although influenza and pneumococcal immunization rates in those 65 years and older are increasing at Overlook Family Medicine, rates need to be

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improved. Strategies to improve immunization rates will include provider and patient reminder systems, and patient education provided by the pharmacist and medical residents to dispel misconceptions regarding immunizations.

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4-019

Category: Ambulatory Care

Title: Impact of interdisciplinary outpatient discharge clinic on 30 day readmission rates for post-hospital discharge patients

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Purpose: Reduction in rates of unplanned hospital readmissions within 30 days of hospital discharge is an important metric for healthcare systems. The utilization of an ambulatory care clinical pharmacy specialist providing comprehensive medication review in conjunction with a nurse practitioner performing physical assessments in a post-discharge outpatient clinic was identified as a potential method for reducing hospital readmissions. The discharge clinic was implemented to improve transitions of care for recently discharged patients and evaluate the clinic's impact on 30 day hospital readmissions at a community hospital.

Methods: An ambulatory care pharmacist in collaboration with a nurse practitioner implemented a multidisciplinary discharge clinic at an outpatient community clinic. Eligible patients were recently discharged from the clinic's affiliated community hospital or emergency department and were unable to obtain a primary care visit within 14 days from the date of discharge. Patients were seen by both the pharmacist and nurse practitioner or nurse practitioner only based upon staffing availability of the pharmacist. At each visit, a comprehensive medication history and evaluation was performed by the pharmacist and medication recommendations were conveyed to the nurse practitioner. The nurse practitioner would perform a physical assessment and, when a pharmacist was not present, perform the medication review. Readmission rates within 30 days were recorded for hospital discharge patients. For emergency department follow-up patients, hospital admissions or additional emergency department visits within 30 days were recorded. For all patients, data was collected for patients seen by the pharmacist and nurse practitioner or patients seen by the nurse practitioner alone from October 2013 through February 2014.

Results: There were 296 patient encounters in the discharge clinic during the 5 month evaluation period of which 148 (50%) were 30 day hospital discharge follow-up visits and 148 (50%) were 30 day emergency department follow-up patients. Of the 296 discharge clinic patient encounters, 22 patients (7%) required readmission, additional emergency department visit, or hospital admission within 30 days of the patient's initial hospital visit. Of the 101 hospital discharge patient encounters seen by both the pharmacist and nurse practitioner, 3 patients (3%) were readmitted within 30 days of hospital discharge versus 8 (17%) of the 47 hospital discharge patients seen only by the nurse practitioner. Of the 87 emergency department follow-up patient encounters seen by both the pharmacist and nurse practitioner, 2 patients (2%) required an additional emergency department or hospital admission within 30 days of the initial emergency department visit versus 9 (15%) of the 61 emergency department follow-up patients seen by the nurse practitioner alone. The readmission outcomes were instrumental in the continued support for the discharge clinic from physician and pharmacy leadership. Additionally, the benefits of the

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pharmacists impact on lower readmission rates versus a nurse practitioner alone justified additional pharmacy staffing coverage for the discharge clinic.

Conclusion: Implementation of an outpatient discharge follow-up clinic can provide an outlet for recently discharged hospital and emergency department patients. When a pharmacist is present in the discharge clinic, patients experience lower 30 day hospital readmission rates and fewer emergency department visits than when seen by a nurse practitioner alone thus aiding in the justification of additional ambulatory care pharmacists at a community hospital.

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4-020

Category: Ambulatory Care

Title: Impact of collaborative transitional care services for diabetes patients: the CO-CARE trial

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Purpose: To assess the impact of a collaborative discharge transition of care (TOC) program on change in health outcomes for uncontrolled diabetic patients.

Methods: Charity patients discharged between February 2012 and January 2014 with an A1C of $\geq 8.5\%$ were screened for inclusion in the study. Patients whom had received post-discharge follow-up through the transition of care program were identified as the intervention group. Patients in the control group were patients whom received traditional post discharge follow-up. Change in Hgb A1C from baseline served as the primary endpoint. Secondary endpoints included 30-day readmission and ED visit rates, change in lipid parameters from baseline, and appropriateness/presence of medications related to coronary heart disease (CHD) prevention.

Results: A total of 81 patients were included in the study. Of these patients, 60 patients received traditional post-discharge follow up (control group) and 21 patients participated in the discharge transition of care program (intervention group). The average change in A1C from baseline was greater among the intervention group (-2.5 percentage points versus -2.0 percentage points, $p > 0.05$). A greater overall reduction in LDL from baseline was seen in the intervention group (-16 mg/dL versus +13 mg/dL, $p > 0.05$). Seven patients (11.7%) were readmitted within 30-days of discharge in the control group compared to three patients (14.3%) in the intervention group ($p > 0.05$). The composite 30-day ED visit or readmission rate was lower in the intervention group (19.0% versus 25.4%, $p > 0.056$). Patients in the intervention group had a higher percentage of statins (80.0% versus 57.1%) and antiplatelets (100.0% versus 66.7%) prescribed when indicated ($p > 0.05$).

Conclusion: The results suggest that collaborative care programs aimed at improving continuity of care post-discharge in patients with uncontrolled diabetes may improve hemoglobin A1C and reduce acute care utilization post-discharge.

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4-021

Category: Ambulatory Care

Title: National trends in primary care visit duration versus quality of care and complexity of medication regimens

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Purpose: With evolving focus on pharmacy practice models, research regarding the complexity and quality of medication use across the nation can be used to promote pharmacy involvement. While the length of primary care visits has increased in recent years, the complexity of medication regimens is also growing. While literature shows the amount of time spent per clinical item addressed during ambulatory visits is decreasing, few correlations between this trend and quality of care have been identified. Our aim was to determine the impact of face to face time spent per medication upon the quality of care provided.

Methods: Following IRB approval, data set files for 2007 through 2010 National Ambulatory Medical Care Survey (NAMCS) were obtained through the Centers for Disease Control and Preventions website. The de-identified data sets were combined and evaluated to include records for patients 18 years of age and older who have a recorded visit including values for face to face time with their primary care physician, diagnoses, and at least four active medications. Logistic regression was completed with the dependent variable being quality of care as defined as: angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (ARB) use in congestive heart failure (CHF), no benzodiazepine to treat depression without concurrent anxiety, ACE inhibitor or ARB use in hypertensive patients with diabetes, statin use in patients with diabetes, and statin use in ischemic heart or cerebrovascular disease. The independent variable was time spent per medication and covariates include sex, race or ethnicity, total number of active medications, and poverty density of the zip code where the encounter took place. The analysis was repeated five times for each of these quality endpoints.

Results: Between 2007 and 2010, the mean number of medications that patients were recorded as taking was 5.9 and the mean face to face time spent per medication was 3.71 minutes. Of the 4.5 billion weighted patient encounters, approximately 530 million met the specified criteria for evaluation. The majority of patient encounters were attended by women (58%) and Caucasians (74%), with private insurance being the predominant form of payment (51%). Time per medication was shown to exert slight changes on quality of care for each endpoint (1.198, 1.018, 0.941, 1.004, 1.013 [all p values < 0.0001]).

Conclusion: The focus to provide high quality patient care at lower costs is ubiquitous to healthcare in the US today. While past investigations have failed to show the impact of time on

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quality of care, a correlation does exist and most often spending more time per medication is linked to improve quality of care.

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4-022

Category: Ambulatory Care

Title: Health care reform and the clinician shortage: maximizing the pharmacist scope of practice to support clinicians with refill authorization in the ambulatory medical office setting

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Purpose: The evolution of the health care system is driving an increased role for the pharmacist. Numbers of available clinicians are being outpaced by new patients with coverage, especially in Primary Care. The Refill Protocol Program is a multi-faceted project intended to improve quality and safety as well as contribute to affordable care by providing increased medication related support to our clinicians and patients. Maximizing the pharmacist scope of practice to support clinicians, the program increases patient access to primary care provider visits and pharmacy services. It also improves medication safety through proper monitoring and accuracy of medication records.

Methods: A Collaborative Drug Therapy agreement was developed between prescribers and pharmacists to allow medication related work to shift from clinicians to pharmacists for accurate and efficient processing. The major components of the Refill Protocol Program project were prescription refill requests, opioid therapy monitoring, and support for medication related calls or messages. Refill requests and messages were accessed by pharmacists utilizing functionality in the electronic medical record. The resulting medication monitoring safety net used evidence-based medicine to apply a standardized process including a proactive review of visit, lab, and adherence criteria to promote the safe and effective use of maintenance medications. Outreach was completed for needed laboratory monitoring, follow up visits, and proper documentation of current medication usage. Additional criteria were established to improve patient safety through the monitoring of chronic opioid therapy prescriptions. This included pharmacist assessment of routine urine drug screen results and documentation of follow up action plans for abnormal screenings. The support for medication related calls and messages focused on responding with accurate and timely information to medication related questions received as patient calls or e-mail messages. These components were designed to maximize the pharmacists scope of practice, contributing to the quality and affordability of patient care.

Results: There was an average of 41,000 refill requests approved monthly by pharmacists to decrease the clinician workload and increase access for their patients. Using pharmacist labor for this support created time for an estimated 86,376 additional clinician office visits equating to approximately 17 clinician full time equivalents, assuming equal productivity and monitoring of criteria. Pharmacists in the program were responsible for approving approximately 75% of refill requests for chronic opioid prescriptions. The criteria applied allowed the organization to take leaps towards ensuring the safe and effective use of these medications at a time when controlled

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substance misuse (accidental or intentional) and abuse has become a significant public health concern. Pharmacist interventions resulted in an 80% improvement in the number of unexpected urine drug screens with timely documentation of clinician action plans. Additionally, pharmacists responded to medication related e-mails and phone calls with timely consultation regarding access, proper use, and adherence to prescriptions. An average of 25,000 medication related calls and messages were handled annually by program staff. Nearly 75% of messages were resolved without further clinician action required.

Conclusion: Many benefits are realized by maximizing the scope of practice for pharmacists to support clinicians with medication related work in the ambulatory practice setting. Pharmacists can assist with medication approvals via Collaborative Drug Therapy Management agreements, respond to all medication related inquiries from patients, and develop innovative methods for assuring safe and effective use of medications. Allowing pharmacists to handle the volume of work related to medication therapy improves patient access to their clinicians. The Refill Protocol Program offers clear advantages, compared to the use of clinician resource, and is a positive step towards a fully integrated health care model.

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4-023

Category: Ambulatory Care

Title: Implementation of the discharge pharmacy program improves patient outcome

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Purpose: Medication errors continue to occur in patients even after discharge from the hospital. Medication reconciliation during admission has shown to reduce medication errors and also improve patient care. Reconciliation is not always done by nursing staff during the discharge process. Medication reconciliation done by pharmacists during the process of the discharge has shown to improve patient outcome through improve compliance and adherence to the prescribed regimen. Patients benefit greatly when prior to discharge, pharmacists review the medication on the inpatient side and compare it with what is prescribed for discharge. In addition, continuation of care and convenience is improved because the patient will not need to make an extra stop at the community pharmacy for their prescriptions. The use of an outpatient pharmacy to fill a patients prescriptions prior to discharge has shown to improve on the outcome of the patient and potentially play a role in reducing readmissions

Methods: In an effort to improve on the patients outcome and reduce re-admissions after discharge, the Medical Center Pharmacy (MCP) at West Virginia University Hospital has implemented a post discharge medication program. Prior to discharge, patients are offered the service to have their prescriptions filled at the MCP. If patients consent to this service, prescriptions are sent to the pharmacy and processed. The pharmacist is then able to reconcile the patients inpatient medication list to what was prescribed for discharge. Interventions are noted and addressed to the prescribing doctor immediately. Upon discharge the patients medication is sent to their bedside and offered counseling.

Results: Since the inception of the program two years ago, MCP has offered this service to over 10,000 discharge patients. Nearly 60% of patients consulted elect to use the discharge service. MCP successfully captures 35% of patients being discharged from the hospital to home. The role of the discharge pharmacist in the continual care of the patient has also showed an impact on patient compliance and understanding of their medication. In addition, this program is pivotal in the reduction of hospital readmissions because of improved compliance and less interruption of therapy.

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Conclusion: Implementation of the discharge program has made a significant impact on the continual care of the patient prior to discharge. Prescriptions filled during the patients discharge showed improved continuation of care and improved outcomes. The impact this program has made can be demonstrated through pharmacys role in the Heart Failure Design Team. The discharge pharmacys role, along with the collaborative efforts of the multidisciplinary team, has decreased the heart failure all cause readmission rate by 6%.

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4-024

Category: Ambulatory Care

Title: Optimizing workflow in an academic ambulatory clinic pharmacy by renovating the existing service area to create a patient-centered experience at a level one trauma center

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Purpose: Patient-centered care is extremely important in today's healthcare model. A pharmacist is positioned to serve as a patient advocate and educator that can help increase a patient's adherence to their medical care plan. The ambulatory care clinic pharmacy is a key piece in our healthcare model that focuses on providing care to an indigent patient population. In order to help improve medical outcomes for this underserved population, it is important to have a pharmacy workflow that maximizes the patient-pharmacist interaction time. This project was designed to renovate an existing pharmacy service area to allow for increased patient-pharmacist interaction time.

Methods: Project funding was pursued through grant applications from several different sources in order to increase the probability of receiving non-budgeted financial support. Grant applications were submitted for both state and organizational funding. The grant applications included details about the project overview, the project benefits, the projected cost associated with the project, and the project timeline. An initial project scope and architectural plan were developed by working with the organization's contractors. Design elements that optimized pharmacy workflow were observed from different practice settings, and evaluated via literature review by the pharmacy department's operations manager. An analysis of the current state and future state pharmacy workflow, along with a value stream mapping were used to help evaluate, design and optimize the pharmacy's processes. In order to assess the primary outcome, time studies were performed for the prescription fill process and patient counseling times. All time studies were conducted by utilizing a stop watch to assess the approximate time associated with each patient t-related process. A log book was used to collect both pre and post renovation time assessments.

Results: Funding for the project was obtained from an organizational grant for the amount of thirty thousand dollars. The project was assigned a tentative timeline of 30 days to complete. In order to improve both patient and prescription throughput, there were several design elements that were incorporated into the new pharmacy layout. These features were inspired by the concept of utilizing an open floor landscape and a left to right systematic workflow. A new prescription drop-off window was built in order to create a distinct prescription drop-off and pick-up area for patients. All of the internal barriers that were present pre-renovation were removed. An island inspired work table was installed in the middle of the pharmacy. A new prescription filling process and filing process were developed. The prescription pick-up station

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was remodeled to include more space for the point of sale system and cash register. All patient related counseling materials were moved closer to the drop-off window, and stored in a new filing storage area. The end result of the new workflow increased prescription throughput time by fifty-three percent. This workflow also increased the time per counseling session by twenty-eight percent.

Conclusion: The architectural plan and project timeline served as instrumental tools for keeping the project on track, on time and within scope. The post renovation workflow greatly minimized the amount of interferences within the prescription fill process that were previously caused by the pharmacy staff and patients. Minimizing these interferences ultimately led to an increased amount of patient counseling time and sessions. The primary outcome for the project was met by allowing the pharmacist more time to reinforce the principles of appropriate medication administration, adherence and medical care compliance.

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Professional Poster Abstract

4-026

Category: Automation / Informatics

Title: Impact of flowcharts on re-enforcing pharmacy technician knowledge of processes with diagramming software

Primary Author: Grishma Desai; Email: Grishma.Desai@bmhcc.org

Purpose: Hospitals strive to implement the Pharmacy Practice Model Initiative (PPMI) by transitioning technicians to non-traditional roles and in turn enhancing direct patient care. Before implementing new initiatives technicians must demonstrate a complete understanding of current job responsibilities through one-on-one training. However, in a time of tight fiscal management, a full time employee (FTE) dedicated to communicating process changes may be cost prohibitive. This case describes utilizing diagramming software to build flowcharts that technicians can independently review for process changes, eliminating the need for personalized training with a FTE.

Methods: In a time of tight fiscal management, pharmacy management identified an opportunity to improve patients perspectives of hospital care and subsequently improve hospital consumer assessment of healthcare providers and systems scores (HCAHPS). Administration had two months to prepare twenty six full time technicians for a HCAHPS pilot program. Due to limited time and lack of a dedicated trainer, technicians were requested to complete a survey to assess baseline knowledge of current job responsibilities. The survey was administered during a five day period and included twelve objective questions. After baseline surveys were collected, flowcharts outlining current technician duties were dispersed to all technicians. Diagramming software was used to efficiently develop complex but easily modifiable flowcharts. At the end of a month, technicians received the same twelve questions in a different order to complete along with a flowchart. The results of this evaluation were reported to the pharmacy administration.

Results: Two of the twenty six technicians surveyed were excluded due to incomplete results after the second survey. Correct responses improved in the survey conducted with flowcharts for all questions among all technicians except one. Mean (range) for the baseline was 5 (1 to 8) versus the repeat survey 9 (4-12). The mean percent change across technicians was 98 percent. Of note, one question which required multiple answers was not answered correctly by any technician in the baseline survey but 67 percent of technicians responded correctly upon repeat questioning. Additionally, improvements were noted across technicians regardless of experience in the department.

Conclusion: Incorporating diagrams, even complex ones, into pharmacy practice can enhance pharmacy technician task knowledge in the absence of a dedicated technician trainer. Pharmacy administration will reproduce the flowcharts to standardized new process changes prior to the commencement of the HCAHPS pilot program.

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Professional Poster Abstract

4-028

Category: Automation / Informatics

Title: Utilization of a pharmacy clinical surveillance system for pharmacist alerting and communication

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Purpose: Pharmacy clinical surveillance systems (PCSS) enable clinicians to intervene on efficacy, safety and cost measures in hospitalized patients. PCSS allow for flagging and documentation of patient care activities and can be modified and adapted to the individual institutions need. In November 2013, Brigham and Womens Hospital implemented a new commercially available PCSS. The objective of this analysis is to describe the utilization metrics of a PCSS at a tertiary, academic medical center.

Methods: We performed a retrospective database analysis assessing rule-based alerts (RBA), interventions and pharmacist communication notes documented in the PCSS from January 1, 2014 to May 31, 2014. Reports were generated on 110 unique RBAs sent to clinicians for evaluation. Of the RBAs, 48 (43.6%) were developed by the commercial PCSS, while the remaining 62 (56.4%) were developed by our institution. Metrics assessed included the number of RBAs that were triggered, clinically evaluated, and intervened on by pharmacists. Other metrics evaluated were based on patient location, pharmacist shift time, and therapeutic category of interventions. Pharmacy communication notes were evaluated during the same time period.

Results: A total of 157,312 unique RBAs were generated through the PCSS. During that time, pharmacists documented a total of 8951 interventions. The most common RBAs were related to lab abnormalities (57,351, 36.5%) and anticoagulation/antiplatelet therapy (50,454, 32.1%). Interventions were most frequently related to RBAs regarding anticoagulation/antiplatelet therapy (2930, 32.7%) and antimicrobial therapy (2272, 25.4%). RBAs and interventions occurred throughout the day, but occurred most frequently during the morning shift (0700-1500). Pharmacist communication was most commonly related to clarification of medication and lab orders, and therapeutic drug monitoring.

Conclusion: Based on utilization metrics of the system, implementation of a new PCSS at Brigham and Womens Hospital has been successful. Further analysis is warranted to assess the impact of the RBAs, interventions, and communication notes on outcomes such as cost of care and adverse drug events.

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Professional Poster Abstract

4-029

Category: Automation / Informatics

Title: Implementation and evaluation of a unified enterprise pharmacy platform (computerized pharmacy system) in a large academic medical center

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Purpose: Increasing the efficiency of medication order prescribed time to pharmacist verification time is a vital component for timely patient care.. Previously, the pharmacy order verification system at NewYork-Presbyterian Hospital was different from the electronic medical record system. In 2013, the previous free-standing pharmacy order verification system with a 1 way orders interface was replaced by the pharmacy module of the electronic medical record . This project was designed to increase the efficiency of medication order to completion time associated with the implementation of an integrated electronic medical record and pharmacy verification system.

Methods: This study was conducted at a 2,600 bed tertiary care academic medical center. Medication orders from January 1, 2012 to March 31, 2012 (pre-implementation of the unified system) were compared to medication orders of the same time frame in 2014 (post-implementation of the unified system). Data from both systems were collected and analyzed including the time the prescriber ordered the medication and the time the order was completed by a pharmacist. Additionally time to order completion was collected and analyzed for specific time sensitive medications including antibiotics and pain medications.

Results: We initially collected and analyzed data from January 2012 to January 2014. Preliminary results show the median time to order completion for the 2012 and 2014 timeframe was 22.2 minutes compared to 8.0 minutes respectively. This represents a decrease of 63.9% in order to completion time with the new unified system. Additionally, median order completion time for NewYork-Presbyterians top prescribed antibiotics was decreased from 24 minutes to 9 minutes and a similar decrease was observed in pain medications of 22.8 to 8 minutes.

Conclusion: Having a unified electronic medical record and pharmacy verification system appears to decrease the time it takes for a pharmacist to complete an order. The implementation of a integrated system at NewYork-Presbyterian Hospital upon preliminary results reduced the median pharmacy to order-verification time by 14.2 minutes (63.9%).

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Professional Poster Abstract

4-030

Category: Automation / Informatics

Title: Shared voice in pharmacy informatics: development and implementation of a shared governance model in bridging the gap between pharmacy and information technology

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Purpose: Shared governance models have been pivotal in the decision making process with practicing clinicians for numerous years, specifically in nursing for more than a decade. The model continues to expand into different areas of healthcare in order to provide opportunity for individuals to share ideas, solve problems and have a say in matters that impact their work. Shared Governance is also a way to improve the lines of communication between units and other departments, since that flow of information results in better care for the patients. This project was designed to expand the shared governance model to the realm of informatics to bridge the gap between pharmacy and technology.

Methods: This project was conducted at a 2,600 bed tertiary care academic medical center. Due to the large size of the medical center consisting of various campuses, the members of the pharmacy informatics leadership identified gaps in improving communication between the pharmacists and pharmacy informatics group . The shared governance model was created to meet with each individual pharmacy group such as adult care, pediatrics, oncology etc. Members of the informatics leadership met with various pharmacy groups on a monthly basis to cover various ongoing projects, demonstrate and educate staff on the functionalities of the order verification pharmacy system, and conducted an open forum for medication safety related suggestions. The pharmacists were asked to make decisions regarding system changes that affect their practice areas at each meeting. An update of the issues identified by the groups was presented at each following meeting to the staff. The pharmacy informatics leadership also held a monthly multidisciplinary group meeting relevant to medication safety and informatics to address some of the issues identified throughout the meetings and health system reported adverse events to find solutions through technology. Each identified suggestion and improvement was also vetted out to other disciplines to derive the most efficient solution.

Results: Regular meetings on a monthly basis empowered the pharmacy staff to improve communication between each other and the pharmacy informatics group. The process identified ongoing issues that were difficult to replicate. Monthly meetings in the shared governance model provided strategies for future enhancements and requests. Participation from pharmacists increased from the initial meeting to subsequent meetings. Survey results indicated the pharmacists felt it was helpful and allowed them to voice their opinion. Pharmacists identified

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time as a limitation of the monthly meetings. Pharmacists felt it was a great way to identify areas for improvement in the order verification pharmacy system and appreciated the time spent to update the staff on the statuses of their requests.

Conclusion: The shared governance model expanded to the realm of pharmacy informatics allow for engagement and empowerment of pharmacists in collaborative activities which contribute to the successful achievement of medication safety related organizational goals.

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4-031

Category: Automation / Informatics

Title: Medication alert settings for hospital pharmacists: the impact on override rates and alert fatigue

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Purpose: Alerts generated by electronic medical record software are a useful tool for pharmacists to evaluate medication orders. However, this software may generate thousands of alerts per day, which may lead to the experience of alert fatigue. Alert fatigue has been defined as a "mental state that results from too many alerts which consumes time and mental energy, which can cause important alerts to be ignored along with clinically unimportant ones". The purpose of this study was to modify medication alert settings such that pharmacists' view of insignificant alerts and experience of alert fatigue would be reduced.

Methods: The institutional review board approved this prospective, longitudinal, single-group pretest-posttest study. The numbers, types, and override rates of electronic medication alerts shown to inpatient staff pharmacists over 31 days were evaluated. Inpatient staff pharmacists were asked to complete an anonymous survey regarding their opinions of medication alerts and their experiences of alert fatigue. The types of medication alerts most commonly viewed by and overridden by pharmacists, and the medications and medication classes most commonly associated with alerts were identified. The types of medication alerts reported as being least useful and as annoyances to pharmacists were also noted. Modifications to medication alert settings were proposed to and approved by the health-system pharmacy leadership group. Changes included suppressing drug-food alerts, alerts generated for specific sodium chloride products, duplicate alerts for placeholder orders, and duplicate medication alerts between inpatient and outpatient medications. Duplicate medication, duplicate therapy, pregnancy, and lactation alerts for medications ordered within obstetric order sets were also suppressed. Finally, duplicate therapy firing thresholds for immediate release narcotic analgesics, antiemetics, and antidepressants were altered. Post-intervention medication alert data was assessed and inpatient staff pharmacists were asked to complete a second anonymous survey.

Results: After the modifications to alert settings were implemented, the number of total medication alerts viewed by pharmacists was reduced from a baseline of 486,355 to 251,173 in a 31-day time period (48.4 percent decrease). The number of medication alerts viewed per pharmacist-verified order was reduced from 4.2 to 2.2 (47.6 percent decrease). Total medication alert override rates decreased by 5.32 percent. Duplicate therapy alerts for immediate release narcotic analgesics, antiemetics, and antidepressants were reduced by 71.1 percent, 92 percent,

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and 90.8 percent, respectively. Duplicate therapy alerts for abortifacients and oxytocics, medication classes included on obstetric order sets, were increased from baseline. After alert settings were modified, 30.4 percent fewer pharmacists reported clicking through an alert notification without reading the alert, 9.52 percent fewer pharmacists noted feeling annoyed with the number of alerts viewed, 8.94 percent fewer pharmacists stated they have felt overwhelmed by the number of alerts viewed, and 6.14 percent fewer pharmacists described feeling mentally tired after receiving alerts.

Conclusion: Modifications to medication alert settings for pharmacists resulted in a lower number of medication alerts viewed and a lower percentage of medication alerts overridden. Adjustments to duplicate therapy firing thresholds for certain medication classes resulted in fewer duplicate therapy alerts associated with those classes, whereas suppression of duplicate alerts for medications ordered within obstetric order sets did not reduce alerts associated with abortifacients or oxytocics. Pharmacists' experiences of alert fatigue, expressed as ignoring alerts, or feeling overwhelmed or mentally tired, was also reduced after alert settings were changed. The ideal medication alert settings for pharmacists are yet to be determined.

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4-032

Category: Chronic / Managed Care

Title: Clinical outcomes of employer sponsored diabetes education and management program

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Purpose: As employers continue to look for innovative ways to cut healthcare costs, it becomes increasingly important to implement new and creative ways of maximizing the benefit of every healthcare dollar spent. Healthcare facilities with self-funded insurance plans are uniquely suited to provide high-quality care at a reduced cost. The St. Rita's D5 4U program was started in September 2009 to not only reduce overall expenditures but also improve clinical outcomes.

Methods: Employees and their covered adult dependents with diabetes or pre-diabetes are eligible for the voluntary program. Participants are self-identified, referred by their provider, identified through the annual wellness lab screening or identified through review of claims data. Once participant and provider approval for participation is obtained, the participant meets with nurse educators, pharmacists, dieticians and exercise physiologists as per the patient's customized care plan. The pharmacists involved in the program provide medication education and medication management as outlined in the collaborative practice agreement. The pharmacists' are further charged with ensuring clinical goal attainment for participants per American Diabetes Association guidelines. Outcomes data are analyzed every three months and compares D5 4U program participants to those patients with diabetes who are not enrolled in the program. Two of the clinical outcomes measured were emergency room (ER) visits and hospital admissions. All data reported is measured per 1000 patients.

Results: For patients who participated over an entire two years (2011 to 2013), ER visits decreased by 35% and inpatient admissions remained stable. The standard care group included members with known diabetes who did not participate in the program. This group noted a 32% increase in ER visits and 41% increase in inpatient admissions over the same time frame. Overall, members who participated in the program had 21% fewer ER visits and 18% fewer inpatient admissions throughout this two year time frame.

Conclusion: Diabetes education and management by a multi-disciplinary medical team, including pharmacists, reduced inpatient admissions and ER visits for covered members.

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4-033

Category: Chronic / Managed Care

Title: Embedding pharmaceutical services into the multidisciplinary team

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Purpose: Hospital pharmacists traditionally do not get involved in the longterm management of patients with chronic diseases in the same way as medical staff and specialist nurses. Highly specialised pharmacists make independent decisions on all therapy areas but now need to move their pharmaceutical core competencies supported by the specialist competencies out of the pharmacy environment into the whole services provision. Pharmacist led clinics are widely reported but no reports of total integration of pharmacy services could be found. This service development aimed to integrate a pharmacy led medication optimisation service for Gastroenterology into the specialist Multi Disciplinary Team (MDT).

Methods: A weekly pharmacist outpatient clinic session was established. Referrals consisted of patients needing to initiate immunomodulating therapies and subsequent biochemical monitoring, patients needing their therapies adjusted due to blood level results, adverse drug reactions (ADRs) or concordance issues. The strategic and operational management of the biologics infusion clinic was transferred to the lead pharmacist. The role included clinical assessment of patients, management of the chronic disease as well as minor ailments and referral to the MDT for review. A new blood monitoring and therapeutic drug monitoring (TDM) service for immunomodulators was introduced to optimise therapies measuring thioguanine nucleotide (TGN) and methylmercaptapurine (MMP) levels for thiopurines and infliximab (IFX) and adalimumab (ADA) levels and antibodies to guide therapy decisions. Rapid access for patients in need of advice on management of their condition or flares was triaged to the appropriate MDT member by the lead pharmacist. MDT approved pathways were developed to initiate and review immunomodulators and facilitated by the pharmacist A workload and prescription audit was conducted for the four months and the financial benefit assessed. All MDT members were asked to fill in anonymously a 360 degree peer review of the lead pharmacist.

Results: 14 clinics were run in the four months analysed, improving access to appropriate care. 138 patients were seen in the pharmacist clinics in that time reducing waiting times and 382 patients had their bloods monitored ensuring clinical governance of therapies. 47 patients had their immunosuppressant therapy adjusted due to the new TDM service, resulting in a minimum of 50,000 savings for the health economy. The pharmacist acts as the gatekeeper for testing and takes over the responsibility of optimising the therapies using the prescribing rights of a non medical prescriber. The biologics infusion clinic was expanded to include new services providing nutritional supplements and iron infusions for gastroenterology and pre-operative patients. The advice required for the rapid access service was identified as primarily nurse orientated and the service was moved to a nurse led service with the lead pharmacist supporting to maximise resources. The MDT reviewed 42 patients according to the developed pathways with 10 patients considered eligible for biologics and 7 patients needed their therapy changed. 6

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responders returned the 360 degree review. All responders were favourable about the service and highlighted positively the integration of the pharmacist into the MDT indicating the wish for the service to continue.

Conclusion: By involving the pharmacist in all aspects of the longterm care of patients with chronic diseases patient safety was enhanced, standardisation of treatments and monitoring was guaranteed and sound governance for individualised medical therapies provided. The focus of the MDT shifted to early medicines optimisation realising considerable cost savings. Interprofessional relationships profit greatly when working closely and deputising for each other. Embedding pharmaceutical skills into the multidisciplinary team influences decision making right at the initial stage, ensuring that services incorporates good medicine management and medicine optimisation principles at conception guaranteeing high-quality, compassionate care and strong governance.

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4-034

Category: Chronic / Managed Care

Title: Therapeutic drug monitoring in inflammatory bowel disease - can it save money?

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Case Report

Purpose: These two cases demonstrate that targeted therapeutic drug monitoring (TDM) in inflammatory bowel disease (IBD) can improve patient disease management through medication optimisation and individualisation of drug therapies. The involvement of a highly specialised pharmacist enables the realisation of considerable savings of 30,000 GBP through professional support and specialist care. Patient 1 transferred to this acute NHS hospital trust for the management of his Crohns disease (CD). This was the fourth hospital he attended and had experienced a wide range of treatment strategies without satisfactory results. He arrived at the biologics infusion clinic managed by the highly specialised lead pharmacist in gastroenterology on a high dose of infliximab (IFX) 10mg/kg every 4 weeks. It was evident that there was an extensive psychological component to this young patient disease as his endoscopic investigations reported disease remission without any evidence of CD activity. The multidisciplinary team decided to start thiopurines based on the latest national guidelines and he was started on azathioprine 150mg daily (2mg/kg). After 4 weeks the pharmacist measured his thioguanine nucleotide (TGN) and methylmercaptopurine (MMP) levels and found them to be undetectable. After a long discussion around concordance and non-absorbance the patient agreed to redo the level in 4 weeks time and the result was in range as the patient was now concordant. Once optimised on thiopurines, the pharmacist suggested to the patient that IFX levels were measured. As expected the IFX levels were above recommend therapeutic levels with undetectable antibodies and the result was discussed with the patient in view of reducing the dose. There was considerable anxiety by the patient to change the therapy as the current treatment was the only effective treatment in his experience. Due to his relationship with the pharmacist managing the infusion clinic, he felt save in increasing the interval and having a rescue strategy in place in case of recurrence of symptoms. He attended the next clinic session six weeks later without his crutches, in full-time employment and with a new girlfriend. He reported an improved quality of life which could either be attributed to the reduced toxicity of IFX or the impact of the girlfriend. Due to the psychological component of his disease a three month interval was considered appropriate for rechecking his IFX levels in view of further reducing his dose. Patient 2 arrived from an overseas country in the infusion clinic on IFX 7.5mg/kg every eight week which he had been prescribed for the last three years since the age of 15 years old. He was started on thiopurines according to national guidelines after review by the MDT. His levels initially were low and his dose was increased according to bloods levels to optimise drug treatment by the pharmacist and his IFX were measured. The reported result revealed sub-therapeutic IFX level and no antibodies. Once optimised on thiopurines the patient was confident with the support of the pharmacist and a rescue strategy to stop the IFX and continue to manage his Crohns disease with thiopurines only. Being a transitional patient there was considerable anxieties from the

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patients parents but with the assurance of the pharmacist that 98% of patients can be recaptured within 6 month of stopping IFX the patient stopped treatment so far successfully. These case reports showcase the importance of competent specialist care when optimising and individualising therapies through TDM. The highly specialist pharmacist is well placed to take over the role to managing this sometimes very emotive area of medicines optimisation. Our pharmacological knowledge and patient counselling skills put our profession in the forefront of managing medication optimisation and individualising drug therapies.

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4-035

Category: Clinical Service Management

Title: Impact of a pharmacist-managed, student-supported, inpatient warfarin education program on HCAHPS scores in a community teaching hospital

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Purpose: The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) is a survey instrument for evaluating patient perspectives on hospital care. In an effort to improve HCAHPS scores and supplement anticoagulation education in alignment with Joint Commission National Patient Safety Goal 03.05.01, we piloted a medication education program that focused on warfarin and utilized pharmacists, pharmacy students, and PGY1 pharmacy residents as the primary providers of patient education. The purpose of this study was to determine how a pharmacist-managed, student-supported warfarin education program targeted on non-critical care units will impact the Medication Communication HCAHPS scores in a community teaching hospital.

Methods: Between June 2013 and December 2013, verbal and written education was provided to patients 18 years old or greater starting warfarin therapy for the first time. Patients were excluded if they had received warfarin prior to admission, were located in maternity, mental health, or critical care unit, or were to be discharged to a rehabilitation center, nursing home, hospice or similar facility. Patients with altered mental status and severe developmental disabilities were also excluded. HCAHPS survey data was collected by an outside vendor and published on the institutions intranet page. The number of patients educated, individual providing counseling, location, age, gender, and warfarin indication were collected and analyzed; Microsoft Excel 2010 was used for data analysis. The primary outcome is the correlation between the number of inpatients educated on warfarin to the Medication Communication HCAHPS score. Secondary outcome measures include patient demographics, pharmacy personnel involvement and the difference between the 2012 and 2013 Medication Communication and Overall HCAHPS survey scores for the institution.

Results: A total of 108 patients new to warfarin therapy were counseled. The average patient age was 61.2 years old and 62 (57.4%) patients were female. The most common indication for warfarin was deep vein thrombosis (DVT), n = 26 (24.1%). Fifty one (47.2%) patients were educated by pharmacy students and residents. The correlation between the number of inpatients provided successful warfarin education and the institutions Medication Communication HCAHPS score was $r = 0.72$. The Medication Communication HCAHPS score for 2013 was

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63.2% compared to 57.6% for 2012; Overall HCAHPS score for 2013 was 69% versus 63.7% for 2012.

Conclusion: Implementation of a pharmacy medication education pilot program focused on a single medication positively correlated with our institutions Medication Communication HCAHPS scores. Pharmacy students and residents play a critical role in extending clinical pharmacy services and may improve patient satisfaction and hospital reimbursement.

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4-036

Category: Clinical Service Management

Title: Utilizing Lean Six Sigma methodology to improve antibiotic level monitoring

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Purpose: Vancomycin (V) and the aminoglycosides are antibiotics with narrow therapeutic windows that require therapeutic drug monitoring (TDM). Timing of specimen collection is crucial to properly assess efficacy, toxicity, and appropriateness of dosing. Utilization data at our institution revealed that less than 50% of ordered V levels were drawn appropriately for level assessment. This resulted in need to repeat levels, and to delayed assessment that contributed to cases of acute kidney injury and increased length of stay. We initiated a project to analyze the level monitoring process in order to identify areas of performance improvement in TDM.

Methods: Baseline data was manually collected from review of level orders from 5/6/2013 to 5/12/2013 by pharmacy. Categories included appropriately ordered and drawn levels, levels not done, levels drawn too early or too late, and inappropriately ordered levels. The entire level monitoring process was then assessed using Lean Six Sigma methodology. The core team included representatives from pharmacy, physician groups, nursing, laboratory, phlebotomy, information technology (IT), medical informatics, and performance improvement (PI). Senior management provided additional support after periodic progress reports were presented. The team mapped out all the detailed steps in TDM from initial placement of level orders through the receipt, interpretation and response to level results. Issues and improvement opportunities were identified and prioritized and used to develop recommendations for process modification that were put into effect in March 2014. Data on level ordering was again collected manually one week after implementation of the new process. A daily report was then created by IT using the Electronic Medical Record (EMR) to simplify the assessment process and validate these results two months after the process change. Potential financial implication was calculated for hard savings (Lab cost) and soft savings (labor cost).

Results: There were 127 levels ordered from 5/6/2013 to 5/12/2013. The numbers of levels drawn appropriately, not done, drawn too early, drawn too late, and incorrectly ordered were 62 (49%), 21 (16%), 10, 23, and 11 respectively. The potential financial saving on lab cost was calculated to be an average of \$93,231/year with estimated savings on labor cost average \$206,621/year. Changes implemented based on the PI process from 5/21/2013 through 3/4/2014 included: education of all staff on the TDM process, timing of levels, and optimizing level ordering time frame, improvement in the level order visibility in the EMR system, un-batching of drug levels from all routine labs, improving communication among all providers, and nursing ownership of drawing of all V levels. Prior to this some levels were drawn by nursing and others by phlebotomy. A weeklong data was collected manually one week after final implementation of

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all process interventions. The proportion of levels drawn correctly significantly increased from 49% to 85% (139/164) and the number of levels not drawn decreased from 16% to 3%. To validate these results, the new electronically generated report was used two months later. The proportion of levels drawn appropriately remained at 87% (148 out of 169 levels).

Conclusion: Improperly executed antibiotic TDM may contribute to potential adverse outcome and costs. PI utilizing Lean Six Sigma methodology was effective in improving the performance of the TDM process for V levels with marked and sustained improvement in appropriately drawn V levels. The collaboration among all disciplines and multiple interventions, most notably nursing ownership of level drawing process, increasing awareness among all staff, and improvement in the EMR system likely contributed to the sustained success in TDM of V.

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4-037

Category: Clinical Service Management

Title: Improving outcomes through protocol standardization for high acuity alcohol withdrawal syndrome patients in a small community hospital

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Purpose: The care of patients presenting with an alcohol withdrawal syndrome is complex and labor intensive particularly in high acuity patients requiring Intensive Care Unit (ICU) admission. It was identified that fragmented and varied treatment protocols administered by healthcare providers led to inefficient use of hospital resources including intubations, ICU admissions, and observation hours (one to one). A coordinated and systematic response from the hospital's healthcare team was required. The pharmacy participated in a hospital wide initiative to implement a standardized program using evidence based guidelines that would pave the way to treatment success for this patient population.

Methods: Utilizing the most recent guidelines for alcohol use disorders a new protocol was created outlining a standardized approach based on best practices. The protocol was then reviewed by psychiatry, emergency medicine, hospitalist service, critical care and clinical informatics. In summary, the prescriber, guided by initial risk stratification criteria, places the patient into one of three categories: low, moderate, or high. Each category has predetermined intermittent benzodiazepine tapering schedules with symptom-triggered as needed benzodiazepine orders. The symptoms were measured using the validated assessment tool, Clinical Institute Withdrawal Assessment Alcohol revised (CIWA-Ar). Computerized order sets and nursing work lists guided intense medical management with frequent medication dosing, CIWA-Ar scores and vital sign assessments. Measures of success were identified to be decreased utilization of continuous lorazepam infusions, observation hours and ventilator days secondary to an alcohol withdrawal syndrome diagnosis. Baseline and post intervention were chosen for comparison and data analysis. Patients records were reviewed for those admitted with an alcohol withdrawal syndrome (AWS) diagnosis code. To account for seasonal variations, data were gathered and analyzed from August 2011 through July 2012 for the baseline period (n = 2893) and compared to the August 2012 through July 2013 group post intervention (n = 2803).

Results: There was a 74.5% decrease in the average monthly usage of continuous lorazepam infusions. An average monthly use of 22 lorazepam infusions decreased to 5.6 infusions post program implementation. A 41.8% decrease in ventilator days secondary to an AWS diagnosis was also noted. A monthly average of 14.6 ventilator days decreased to 8.5 days per month post program. Observation hours dedicated to this patient population were also decreased by 3.3%. In the baseline 12 month period, observation hours averaged 12.3 hours per patient visit while the post program time period averaged 11.9 hours per patient visit.

Conclusion: Implementation of an aggressive alcohol withdrawal syndrome protocol led to decreases in the use of lorazepam infusions, ventilator days, and observation hours in high acuity

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patients. In addition to a positive impact on utilization of hospital resources, our intervention potentially decreases the risk of complications such as ventilator assisted pneumonia and deep vein thrombosis.

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4-038

Category: Clinical Service Management

Title: PPMI self-assessment: Incorporating APPE students into daily practice

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Purpose: To adequately develop a practice model responsive to healthcare reform and patient care needs, a pharmacy department must conduct a PPMI self-assessment, which addresses incorporating advance pharmacy practice experience students (APPEs) into daily activities. This allows for an increased pharmacy clinical and administrative impact within an acute care facility. A standardized and structured approach to orientation and accountability is required to ensure success. The impact must be measurable to justify the approach to the institutions administration and practitioners; and, should provide a positive educational experience. This project was to expand clinical rotations from twenty to sixty-four each year.

Methods: Prior to the 2013-14 APPE academic year the colleges collaborated to establish a consistent schedule to allow for two months of experiences sequentially for each APPE. A team of pharmacy staff and managers created an APPE committee with required monthly meetings. A clinical staff pharmacist is the chairperson of the APPE committee. The initial charge of the committee was to address scheduling, resources, standardization, and preceptor training. Standardization occurred in the areas of learning activities, learning objectives, initial communication, orientation and training, topic discussions, formative and summative evaluations, journal club, patient presentation, and remediation. Ongoing meetings of the APPE committee have allowed for improvements such as incorporating new technology into initial communication, reorganization of scheduling of management and clinical learning experiences, expansion of clinical services, exit evaluations, utilized teaching materials, and incorporating a PGY-1 pharmacy resident into journal club and patient presentations. Project success for the institution was to be determined by increases in documented clinical encounters, CMS Core measures (STK-1, VTE-1, VTE-2, and VTE-5), and HCAHPS scores related to discharge medication education. Project success for the rotating APPE was to be determined by increases in post rotation exam scores and feedback from exit interview surveys.

Results: The overall average of documented clinical interventions increased from 3460 (SD 1039) to 7738 (SD 1124) in the preceding and following ten months, respectively. The majority of these clinical interventions were categorized as patient medication counseling, CMS core measure reviews, and therapeutic monitoring. The overall average score of pharmacy monitored CMS Core measures of STK-1, VTE-1, VTE-2, and VTE-5 increased when compared to the

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preceding ten months (i.e. 57.4% [SD 17.9%] vs. 98% [SD 4.7%]; 70% [SD 9.5%] vs. 97.4% [SD 4.6%]; 78% [SD 12.7%] vs. 99.5% [SD 1.6%]; and 86% [SD 13.6%] to 100%, respectively). Overall HCAHPS survey results related to understanding medications upon discharge from targeted nursing units changed from 85.7% to 84.3% from the preceding ten months, respectively. The monthly average of pre and post-rotating APPE rotation exam scores increased from 52.2% (SD 8.3%) to 79.6% (SD 10.4%), respectively. The numbers of completed exit interviews surveys were too small to include in the analysis.

Conclusion: Incorporation of APPE students into a clinical program as patient care extenders was successfully completed. The project increased measureable applications of evidence based medicine by means of CMS Core measures and documented clinical interventions. Increases occurred without a negative impact on other clinical pharmacy services. Although the positive impact on patient discharge medication education was not reflected in returned HCAHPS surveys, a needed clinical service was added. In addition, a positive clinical experience for APPEs was reflected by the increased rotation exam scores. A more structured process must be established to ensure the completion of exit interview survey results.

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4-039

Category: Clinical Service Management

Title: Using principles from the pharmacy practice model initiative to help transform a pharmacy practice model at an academic level one trauma center

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Purpose: Pharmacy practice models continue to evolve in order to meet the needs of a dynamic healthcare industry. The department of pharmacy identified that it was imperative to assemble a team of professionals to help develop new clinical services and expand upon existing services. The purpose of this project was to assemble a pharmacy practice model initiative work advisory group that would help advance the pharmacy departments clinical practice and patient outcomes.

Methods: The department of pharmacy asked employees if they would like to participate in a work advisory group in order to help advance the pharmacy practice model. A work advisory group was assembled for both pharmacy technicians and pharmacists. The pharmacy practice model initiative hospital self-assessment was completed to identify areas of opportunity for improving the current pharmacy practice model. A current state and future state analysis were also completed to help assess the pharmacy practice model baseline.

Results: Work advisory groups were formed for both technicians and pharmacists to help improve the current practice model. It was determined that a monthly meeting schedule would be optimal for the departments work groups. Subgroups were developed to help focus team member efforts. These workgroups identified several areas for improvement and standardization within the pharmacy department. These areas included a workflow and documentation process for patient counseling and medication reconciliation, patient progress note documentation, application of drug information resources to direct patient care, and how to assess a patients medical record to identify and solve drug related problems. After creating standards of work for each of these areas, an educational boot camp program was developed. The purpose of this education boot camp was to prepare staff pharmacists for decentralized practice on the nursing unit. A new staffing assignment was also created for decentralized practice from the existing central pharmacy assignments.

Conclusion: The pharmacy practice model initiative work advisory groups were able to effectively identify, create, monitor and adjust activities within our current practice model. These work groups will continue to work on developing additional clinical services in order to help improve the quality of care provided at our institution in the future.

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Professional Poster Abstract

4-040

Category: Clinical Service Management

Title: Improved alteplase administration utilizing smart technology for ischemic stroke patients decreases time from hospital arrival to initiation of thrombolytic therapy at a community hospital

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Purpose: Bolus and infusion administration of alteplase, recombinant tissue-type plasminogen activator (t-PA), for ischemic stroke within 3 hours of last known well- time is the accepted American Heart Association guideline for patients who meet criteria. Alteplase dosing, reconstitution, and administration is difficult to accomplish quickly when done manually. Utilizing weight-based computer order entry, STAT ordering with pharmacist verification, pharmacy reconstitution, and smart pump infusion devices to administer the t-PA bolus and infusion may be more accurate and efficient. This study evaluated the impact of more advanced and efficient technology to improve times for the administration of alteplase for ischemic stroke patients.

Methods: Alteplase dosing for treatment of ischemic stroke is based on patient weight. The previous process included manual calculations of bolus and infusion doses then separate entry into the computer system, reconstitution, and preparation of the doses. Utilizing computer programming, weight based calculations were created specifically for alteplase for treatment of ischemic stroke with one entry to include both bolus and infusion doses with a default priority of STAT. Physicians were trained to enter alteplase for stroke using computer order entry. Pharmacists verified the patient weight to ensure that dosing limits were not exceeded. With the revised process, reconstituted product of 100 mg/100ml is always prepared in pharmacy IV room and sent without having to manipulate for bolus or infusion. Smart infusion pumps were updated to also include weight-based programming of a bolus and infusion from one container. Nurses were trained on the computer and pump changes. Conversion took place December 2012. Control period was all of 2012 and included 17 patients, and the study period, January 2013 to May 2014, included 37 patients.

Results: From 2012 thru April of 2014, the time from order entry of alteplase to the time of bolus administration was reduced by an average of 55%. Each year, the time from order entry to administration decreased and for 2014 was on average 18 minutes. During the same time frame, a 45% increase was demonstrated in the percent of acute ischemic stroke patients receiving t-PA therapy within 60 minutes or less of hospital arrival. Since conversion, for patients arriving within 2 hours of onset of symptoms, 100% received alteplase infusions within 60 minutes thus meeting and exceeding the current Center for Medicare and Medicaid Services core measure resulting in Joint Commission stroke certification.

Conclusion: Utilization of smart technology to increase accuracy and efficiency of alteplase preparation and administration helps increase percentage of patients who receive therapy within 60 minutes from hospital arrival.

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4-041

Category: Clinical Service Management

Title: Utilizing lean methodology to reduce readmissions via Project Re-engineered Discharge (RED) at a large academic veteran affairs medical center

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Purpose: Hospital readmission rates for heart failure and post-colorectal surgery patients were higher than the VA national benchmark. The facility became involved with Project Re-engineered Discharge (RED) to help reduce hospital readmissions in these target populations. Pharmacy department was involved in several elements to optimize the discharge medication management process. Ultimately, the goal was to improve interdisciplinary collaboration with other care lines and overall communication between inpatient clinical and outpatient pharmacy staff.

Methods: hospital-wide Project RED committee was formed under the leadership of the Associate Chief of Medicine. Pharmacy was charged with the element involving discharge medication management. Pharmacy element members included the inpatient clinical pharmacy program manager, the outpatient pharmacy program manager, inpatient clinical specialists, outpatient clinical pharmacists, the administrative management resident, and pharmacy technicians. The pharmacy members collaborated with providers, nurses, quality management, the informatics pharmacist, and the Office of Informatics and Technology. A process map was created depicting our current and target states to assist with a gap analysis. Several shortcomings were identified leading to different strategies to optimize the patients discharge process and interdisciplinary communication. The pharmacy committee met biweekly to develop Standard Operating Procedures (SOP) and to review barriers during implementation of the pilot projects.

Results: Pharmacists roles were restructured to expand communication and enhance collaborative practice leading to a decrease in overall readmission rates of heart failure patients. This was achieved through medication reconciliation, medication delivery, bedside counseling, and post-discharge telephone follow up.

Conclusion: Being involved with Project RED, pharmacy was able to provide a continuity of care for patients upon discharge. The next step is to further coordinate the medication discharge process between inpatient clinical pharmacy specialists and outpatient clinical pharmacists.

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4-042

Category: Critical Care

Title: Evaluation of a decentralized pharmacy service model in the critical care unit at a non-profit community hospital

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Purpose: Critical care pharmacy services have expanded from dispensing responsibilities to being recognized as an essential component of multidisciplinary care. This shift in roles has allowed pharmacists to incorporate themselves into the care team by optimizing pharmacotherapy decisions and improving medication safety. Moreover, there is substantial literature to support the value of the pharmacist as a member of an interdisciplinary critical care unit (CCU) team. The pharmacy at St. Josephs Wayne Hospital (SJWH) recently implemented a new decentralized pharmacy practice model in the CCU. The purpose of this study was to assess the implementation of a decentralized pharmacy practice in CCU.

Methods: A retrospective evaluation of medication related interventions made by pharmacists in the CCU in control and experimental group was used. Documented interventions were analyzed over 3 months in each group; from October 2013 to December 2013 for the control group and from January 2014 to March 2014 for the experimental group.

Results: The experimental group had more interventions made (1030 interventions per 1000 patient days) than the traditional group (842 interventions per 1000 patient days). Among 1027 interventions made in the experimental group, 467 (45.5%) were on laboratory monitoring, 346 (33.7%) were on renal dose monitoring and 88 (8.6%) were on antibiotic reviews. In the control group, 376 (46.3%) were on laboratory monitoring, 244 (30%) were on renal dose monitoring, and 65 (8%) were on intravenous to oral conversions. Even though the sum of interventions is similar in both control and experimental groups, the types of interventions made were different between the two groups. The Interventions on antimicrobial stewardship, drug information, blood glucose monitoring, and therapeutic drug levels were done more in the experimental group when compared to the control group. 114 medication therapy changes were made in the intervention group and 109 changes were made in the control group among the interventions made by the pharmacists and therefore potentially prevented adverse drug events. The majorities of changes were on renal dose adjustment on both experimental (n= 19) and control group (n=20). The estimated medication cost savings from the interventions was \$7,610 for the control group and \$7,097 for the experimental group.

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Conclusion: The addition of decentralized pharmacist to the CCU allows more medication related interventions to be made and potentially decrease the incidence of adverse drug events, drug charges in the CCU. Medication and system or IT related issues are being addressed and resolved in a timelier manner. The decentralized pharmacist was also involved as a member of CCU rounds and rapid response team. In conclusion, although there is still room for improvement in the range of pharmacist involvement in the CCU at SJWH, a decentralized CCU pharmacist makes important medication recommendations when included as an active member of the interdisciplinary team.

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4-043

Category: Critical Care

Title: Development and implementation of a comprehensive order set for aerosolized epoprostenol

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Purpose: Epoprostenol is approved for the intravenous route and regarded as a high-alert medication due to its risk of significant patient harm. Aerosolized epoprostenol (aEPO) has been used in the treatment of pulmonary hypertension and life threatening respiratory failure. This project was designed to mitigate medication errors associated with the prescribing, dispensing, and administration of aEPO.

Methods: A critical care pharmacist, physician, registered nurse, respiratory therapist, and an informatics pharmacist identified gaps in providing a consistent and safe delivery of aEPO. Policies and procedures for the use of aEPO were updated and an order set was developed. Strategies implemented to ensure a consistent and safe method of delivery of aEPO included restricting the prescribing of aEPO to critical care physicians, using a syringe pump for the delivery of aEPO, and the use of an order set. The order set was created within the computerized physician order entry (CPOE) system and embedded with clinical decision support. Policies and procedures for the use of aEPO were updated. As the order set was being developed members from informational technology assisted with the order set development. Prior to activation of the aEPO order set extensive testing was performed to ensure accuracy and ease of use.

Results: A seamless process of prescribing, dispensing and administering aEPO has transpired since the implementation of the order set. With the use of a clinical decision support, prescribers first must choose an indication for aEPO from a dropdown list. Next, a fixed concentration of aEPO is automatically populated and the prescriber must choose a dose from a dropdown of 5 choices. Finally, a pop-box communicates to the prescriber what criteria should be met for the continuation of aEPO after a thirty minute trial and parameters that must be monitored depending on the indication selected. This order set ensures appropriate selection of patients that would benefit from aEPO therapy. In addition, complex calculations involving ideal body weight and a unit of measure not commonly used (nanograms) have been eliminated.

Conclusion: Medication errors are a significant concern in the administration of aEPO. Implementation of an order set for the administration of aEPO within the CPOE system with clinical decision support is essential to mitigate medication errors and enhance patient safety.

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4-044

Category: Critical Care

Title: Clinical efficacy and economic benefits of continuous- infusion of meropenem vs. intermittent- infusion in intensive care unit patients.

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Purpose: Continuous infusion of -lactam antibiotics has been widely promoted to optimize their time-dependent activity. This advantage of continuous infusion translates into superior ability to achieve pharmacodynamic targets. This study evaluates clinical efficacy and cost reduction in using continuous infusion in comparison to intermittent infusion of meropenem in Intensive Care Unit (ICU) patients at 'Barzilai' Medical Center.

Methods: A cohort study of patients treated with meropenem for pseudomonas aeruginosa susceptible infection was performed. During a three years period (2008-2010), all patients received the intermittent infusion, while during 2010-2013 all patients received the continuous infusion of meropenem. Eligible patients who were included in this study, received the drug at least five days without any change in antibiotic treatment. Data on demographic characteristics, microbiology, co-morbidity, mortality, re-hospitalization, length of treatment and of hospitalization were collected and compared between groups. Statistical evaluation was performed with the t and chi square tests. The study was approved by the hospital's RBA.

Results: A total of 189 critically ill patients comprised the two study groups; 97 patients were treated by intermittent administration of 2g IV every 8 h and 92 received meropenem as a 2g IV loading dose, followed by a 3g continuous infusion over 24 hours. No significant differences were observed in base-line clinical characteristics between the two groups, length of stay (LOS), mortality during treatment, and length of treatment. A significant difference was found regarding re-hospitalization rate and cost of treatment, when using the continuous infusion of meropenem.

Conclusion: Clinical outcomes were similar in the two groups. There was a significant reduction in re-hospitalization and treatment expenditures when using continuous infusion versus intermittent ones.

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4-045

Category: Critical Care

Title: Extended stability of reconstituted chlorothiazide vial

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Purpose: Chlorothiazide is a thiazide type diuretic that inhibits sodium re-absorption in the distal tubule, also leading to increased excretion of sodium and water. Chlorothiazide can be administered intravenously(IV) as multiple intermittent doses or as a continuous infusion to achieve desired level of diuresis. The package insert for chlorothiazide sodium injection recommends aseptic preparation for reconstitution and disposal of unused vial portion which is not intended for immediate use. The cost per vial of chlorothiazide greatly exceeds other more commonly utilized IV diuretics (trying to link why not first line agent Costly??). The purpose of this study was to determine if chlorothiazide is stable for 96 hours when reconstituted and stored in manufacture vial at 4C.

Methods: Chlorothiazide (500 mg vial APP Pharmaceuticals, Schaumburg, IL) was reconstituted with Bacteriostatic Water for Injection, USP (APP Pharmaceuticals, Schaumburg, IL), resulting in a final concentration of 28 mg/mL. The solution was visually examined for color change against a white background and for haze, turbidity, gas bubbles, and precipitation against a black background. These evaluations were done immediately and after the samples were stored at 4C in the dark for up to 96 hours to simulate storage under normal clinical use. Fresh control samples were prepared each day prior to liquid chromatography tandem mass spectroscopy (LC/MS/MS) analysis to account for daily variations in MS signals. Experimental values were adjusted based upon the fresh samples being 100% of the signal. Visual compatibility was defined as the absence of any haze, turbidity, precipitation, color change, or gas bubbles. Stability was defined as not less than 90% of the initial drug concentration remaining in the admixtures. Reference standard of chlorothiazide was obtained from USP (Rockville, MD) and dissolved in equimolar NaOH solution. Prior to the stability study, LC/MS/MS methods were developed to separate, detect and measure chlorothiazide. Chlorothiazide was detected using an Agilent 6460 Triple Quad LC/MS/MS equipped with an ESI source. MS conditions were: gas temperature 350C and flow rate 10 L/min; sheath gas temperature 400C, flow rate 12 L/min; nebulizer pressure 45 psi; capillary 3500 V and detector in negative ion mode. Chlorothiazide primary ion was 294- and fragment ion 214.1- with fragmentor set at 150 V and collision energy 12 eV.

Results: Chlorothiazide typically eluted from the chromatogram at 1.7 min. An initial dilution range was prepared to determine the linear range of the LC/MS/MS assay. The assay for

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chlorothiazide was linear from 80 to 2,000 ng/mL. The commercial sources of chlorothiazide retained 100% of the original concentration for the 96 hours of this study.

Conclusion: We conclude that chlorothiazide reconstituted with bacterostatic sterile water for injection at a concentration of 28mg/mL and stored at 4C will retain > 90% of the original compound for at least 96 hours. The ability for a healthcare facility to utilize a beyond use date of 96 hours from preparation can result in a significant reduction in healthcare expenditures. A 12 month drug acquisition review during 2012-2013 indicated Alfred I. duPont Hospital for Children would be able to recognize a \$45,080 reduction in chlorothiazide costs solely by extending the vial expiration from 24 hours to 96 hours.

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4-046

Category: Critical Care

Title: Electrolyte disturbances and management at the intensive care units (ICU) in Lebanese University Hospitals

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Purpose: Electrolyte disturbances are among the most common clinical problems encountered in the ICU. A recent study revealed that dysnatraemia in the ICU (even mild) is an independent predictor of increased hospital mortality. Moreover hypokalaemia is a common problem in critically ill patients, if untreated, can result in dysrhythmia. In addition magnesium deficiency correlates with a higher mortality and worse clinical outcome in the ICU. So the purpose of this study is to evaluate the frequencies and the management of electrolyte disturbances in ICU as well as to identify the role of clinical pharmacist in optimizing ICU patient care.

Methods: This is a prospective multicenter chart review, conducted from February till May 2014 after the approval of the Institutional Review Boards. All ICU patients records were screened for adult patients (>18 years) with electrolyte disturbances (Na^+ <135 or >145, K^+ <3.5 or >5, Mg^{++} <1.5 or >2.4). Patients with active cancer or any hyperglycemic crisis were excluded from the study. The data was collected using a data collection sheet consisting of three parts; one for patients demographics, the second for patients charts and the third for assessment. The management was assessed in terms of rate of correction for the dysnatremias and dose and route of administration for the others. Once the rate of correction of dysnatremia is correct the management was considered to be correct, whereas, for the others, both the dose and the route of administration had to be correct. Whenever an error was detected the pharmacist raised an intervention for the responsible personnel (resident or attending physician) to be discussed and if it was approved or rejected the result was recorded on the data collection sheet

Results: A total of 104 patients were screened 80(77%) patients met the inclusion criteria. 36(45%) had dysnatremias: 30(37.5%) hyponatremic and 6(7.5%) hypernatremic; 28(35%) had dyskalemia: 25(31.25%)hypokalemic and 2(2.5%) hyperkalemic; 14(17.5%) had multiple disturbances: 10(12.5%) had Na^+ , K^+ and Mg^{++} disturbances, and 4(5 %) had Na^+ and K^+ disturbances. Concerning dysnatremia, 10 received incorrect management: 5 were corrected faster while the other 5 were corrected slower than required. For dyskalemia, 23 patients received incorrect management: 8 received wrong dose, 8 received wrong route of administration and the remaining 7 received both wrong dose and route of administration. In patients with multiple disturbances, 1 patient who was hypernatremic and hypokalemic received a faster correction rate for the dysnatremia and an overdose for the hypokalemia. A total number of 35 (43.75%) incorrect managements were detected, 23 interventions were submitted while 11

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interventions were required but not submitted due to patient death or ICU discharge. 16 interventions, were submitted and accepted (4 for the rate of correction of dysnatremia, 3 for the wrong dose of potassium supplement, 8 for the wrong route of potassium administration and 1 for both wrong dose and route) $P < 0.05$.

Conclusion: According to our study, the most prevalent electrolyte disturbance at ICU is hyponatremia and hypokalemia 37.5 % and 31.25 % respectively. Finding a prevalence of 77 % of electrolyte disturbances where 43.75% of them received incorrect management raises concerns for patient morbidity and mortality. The treatment of electrolyte disturbances is crucial for the patients that require frequent monitoring and interventions. The role of clinical pharmacist at ICU has been shown to be effective in improving the patient care and therapy.

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4-047

Category: Drug Information

Title: Assessment of Lebanese community knowledge about over the counter common cold and cough medications

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Purpose: The use of over the counter (OTC) drugs is growing in the Lebanese society, especially the use of common cold and cough products due to their availability, efficacy, and low price. However, knowledge about those medications may not be sufficient. The purpose of this study was to evaluate patients knowledge and level of awareness about OTC common cold and cough medications in the Lebanese community.

Methods: This is a cross-sectional observational community-based study. Patients aged 18 years and above were included. Patients who were health care professionals (physicians, pharmacists, and nurses) were excluded. A structured survey with close-ended questions was used to investigate the knowledge, attitude, and use of OTC medications for self care of common cold and cough. The data collection was performed over a 3-month period. A total of 600 patients were screened, yet only 423 have met the eligibility criteria and were included in the study. The primary outcome measure was assessment of patients knowledge about OTC common cold and cough medications. The secondary outcomes included identification of the sources of patients information regarding OTC common cold and cough medications, and factors that influence their product selection.

Results: Most patients had good knowledge about OTC common cold and cough medications. 70.4 percent identified that those products cannot be used by pregnant women and children, and 83.7 percent were aware that those drugs cannot be taken for a long period of time. Moreover, when asked about the reasons to stop self care and seek a medical attention, most patients considered a high fever (64.3 percent), followed by no improvement of the medical condition after 5 days of self treatment (44.6 percent) as the major reasons. For the secondary outcome measures, most patients were found to read the drug information present on the label, yet only 36.2 percent fully understand the drug label. Therefore, 68.6 percent were relying on the pharmacist as their primary source of drug information. Similarly, the major factor that influenced patients selection for an OTC common cold and cough product was a recommendation by a community pharmacist (73.5 percent).

Conclusion: Good knowledge and level of awareness was found in the Lebanese community with respect to the use of OTC common cold and cough medications. As well, the community pharmacist was identified as a trustful and reliable source of drug information. However, most

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patients were unable to fully understand drug labels. Hence, this requires greater educative efforts from community pharmacists to ensure an optimal self care of common cold and cough.

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4-048

Category: Drug Information

Title: Formulary management system best practices from top performers in controlling drug expenditures

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Purpose: To identify formulary system best practices to meet efficacy, safety, and community needs while controlling and reducing drug expenditures.

Methods: Top-performing hospitals in maintaining drug expenditures were identified using the University HealthSystem Consortium Clinical Data Base/Resource Manager. A 19- question survey was sent to 16 hospitals to assess Pharmacy & Therapeutic (P&T) committee structure, formulary management, medication utilization tracking, and behavioral change initiatives.

Results: Nine sites responded to the survey (56% response rate). All sites had at least 2 P&T subcommittees with a mean of 5 subcommittees. Infectious Disease and Anticoagulation subcommittees were the most common. Simple financial evaluations were conducted for new formulary reviews by 100% of the respondents. Annual formulary reviews focused on safety, non-formulary drug use, formulary drug use, cost, and therapeutic interchanges. Eight sites maintained an electronic or web-based formulary management system. The respondents supported antimicrobial and anticoagulation stewardship programs. The most common behavioral change initiatives included direct communication between pharmacists and prescribers on rounds and clinical decision support upon order entry.

Conclusion: The survey results reflected responses of large teaching hospitals. Many of the sites had support from drug information services, and all sites had pharmacy residency programs. Subcommittees focused on drug outcomes and stewardship programs versus specialty areas. The top performers have a high level of pharmacy oversight for formulary management and technology resources allowing for clinical decision support and electronic formulary access.

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4-049

Category: Drug Information

Title: Can pharmacists improve patient discharge by medication reviews, medication report and patient-dialogue?

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Purpose: Patient-transition between hospital and primary health care is a critical step regarding transfer of medical informations. In early 2012, a pilot study at the Cardiology ward (Svendborg Hospital, Denmark) revealed a need for increased focus on medication. The study of 23 patients found that 90 percent of 147 medication changes (MC) made during admission were not specified in the discharge summaries. Hence, the aim of this study was to evaluate if medication reviews made by a pharmacist contribute to rational pharmacotherapy and whether a pharmacist contributes to descriptions of MC and thus, reduce the number of medication-related calls post-discharge.

Methods: A pharmacist conducted this study at the Cardiology ward Monday to Friday from 8 a.m.-2 p.m., September - December 2012. One month previously, the ward started registering the number of medication-related calls. Patients aged 18 years and older were included if they had MC during admission. MC were defined as intended/unintended differences between medication on admission and medication prescribed at discharge. The pharmacist performed medication reviews and patient interviews with focus on indication for treatment, drug dose, adverse drug events, duration of treatment, interactions etc., resulting in recommendations. At the time of patient discharge, the pharmacist presented recommendations to the hospital physician. The recommendations were either accepted by the physician or sent as a part of the discharge summary to the family physician. Through patient-dialogue, the pharmacist informed the patient about MC in addition with relevant medical information. The pharmacist completed the medication report which included the current medication list and descriptions of reasons for MC. This report was transferred to the patient discharge summary after consultation with the physician. Finally, the report including recommendations was sent to the patients family physician. The study was evaluated by satisfaction surveys and number of medication-related calls.

Results: A total of 106 patients were included, and medication reports made by the pharmacist were sent to 97 patients. The remaining 9 reports were not sent due to the time of discharge where the clinical pharmacist was not present. The medication reports specified 3.9 drugs/patient were added during admission. 1 drug/patient was changed (drug dose or strength) and 1.3 drugs/patient were discontinued. The medication reviews by the pharmacist resulted in 158 recommendations for 83 patients. The most frequent recommendations included duration of treatment (53 recommendations), choice of drug (23 recommendations) and drug dose (15

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recommendations). The hospital physicians accepted 106 recommendations. In addition, 16 recommendations were sent to the family physician after consultation with the physician. This corresponded to 122 recommendations found relevant by the hospital physicians (77 percent). The remaining recommendations were either not presented to/not accepted by a physician or not sent to the family physician due to the time of discharge (as mentioned above). The satisfaction surveys showed that physicians and nurses were positive about the medication reviews and the descriptions of MC by a pharmacist. Furthermore, the study indicated a reduction of medication-related calls after discharge.

Conclusion: Recommendations due to medication reviews by the pharmacist were found relevant by the hospital physicians. Patients were discharged with discharge summaries including the medication report describing reasons for MC by the pharmacist. A reduction in medication-related calls after discharge was reduced, and the pharmacist received positive response from nurses and physicians.

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4-050

Category: Drug Information

Title: Improving medication safety by patient empowerment - Illustrated medication schedules during hospital stay

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Purpose: Today various methods are used to increase medication safety during hospital stays. However patients themselves are seldom involved in activities designed to improve the medication administration process. Hospitals in Germany are obliged to provide inpatients chronic medications during hospital stays. Upon hospital admission the patients medication is switched to products listed in the hospitals formulary. In general nurses fill the oral medication in 24 hours dosage boxes. The oral medication supplied may look different from medicines taken at home, therefore inpatients cannot identify their medication and they do not recognize newly prescribed drugs.

Methods: The study was designed as a prospective randomized trial on two wards of the Cardio-Thoracic and Vascular-Surgery Clinic of a university hospital. Inclusion criteria for study enrollment were age of 65 years or older, more than four drugs at the time of admission and an indication for a bypass- or valve-surgery. After cardiac surgery a clinical pharmacist handed out the patient specific medication schedule to patients in the intervention group, informed these patients about side effects of new drugs and explained medication changes. The schedule includes coloured photographs of each oral medication along with the brand name, INN-name, time and method of administration, indication and specific information as required. Shortly before discharge a questionnaire was handed out to the patients in the intervention and control groups. This way patient's knowledge about the medication regimen during hospital stay was tested and compared with the patient's medication record. Three items on the questionnaire were determined to analyze by statistical methods the patients knowledge of their medications during their hospital stay. These included (i) name, dosage, and frequency of each medication prescribed (ii) indications and (iii) scheduled duration of antiplatelet and/or anticoagulant therapy.

Results: 244 patients were randomized (intervention group (IG) n= 118, control group (CG) n= 126). The mean age was 73 years (SD 5) and the average number of drugs taken at admission was 7 (SD 2). To 101 out of 118 patients in the IG a patient individual medication schedule was handed over. Questionnaires were distributed to 77% of the patients (188 out of 244 IG plus CG) and answered by 77% (n=145) to be analysed. Patients educated with illustrated medication schedules possessed significantly better knowledge about indications of the drugs than patients of the CG (p<0.001) and were more familiar with drug names (p=0.049). Furthermore patients of the IG had better knowledge about the scheduled duration of acetylsalicylic acid (p=0.038) or

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clopidogrel therapy ($p=0.011$). The knowledge level about the planned duration of Vit K antagonist therapy did not differ between the two groups ($p=0.325$). More patients of the IG were able to identify their medication than of the CG. 80% of patients in the IG reported increased motivation to take their medication as prescribed. More than 90% of the patients in both groups are eager to receive an illustrated medication schedule during their hospital stay and/or at discharge.

Conclusion: During this study patients were empowered by being provided patient individual medication schedules including colour photographs of the oral medication. Patients knowledge about their drug therapy and drug usage was significantly increased by pharmacists counselling based on the printed medication plan. The informed patients were more easily able to play an active role in identifying their drugs and performing proper drug intake during their hospital stay. Patients feedback was very positive. Further studies are necessary to confirm the beneficial impact of illustrated medication schedules on medication safety and patient compliance in hospitals.

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4-051

Category: Drug Information

Title: Impact on pharmacists of a national diabetes grand rounds educational initiative to improve inpatient glycemic control and preventing hypoglycemia in the hospital setting

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Purpose: Diabetes is a common condition in hospital settings and was a primary or secondary diagnosis in more than 5.3 million hospital discharges in 2010. Healthcare performance gaps demonstrate inadequate achievement of goals, lack of protocol development, persistent use of sliding scale insulin, and a need for improvement in efforts to reduce the risks of hypoglycemia and improve transitions of care, particularly to the outpatient setting. The 2012-2013 National Diabetes Grand Rounds (DGR) education initiative for healthcare professionals was designed to improve the competence and performance of the interprofessional team caring for these patients, and ultimately improve patient outcomes.

Methods: The initiative, supported by an educational grant from Novo Nordisk, consisted of four different independent modules, including a module specifically for pharmacists, presented to healthcare professionals on-site at their institutions. Participants could elect to participate in one or more of the modules. These modules were certified for continuing education (CE) credit for physicians, nurses, and pharmacists. All modules were developed by a multidisciplinary steering committee including a pharmacist. The DGR provided an opportunity to gather data to verify and optimize the impact of the curriculum, as well as to gather insights and information about those involved in the treatment of inpatient hyperglycemia. Learners responded to questions upon completing the modules, which: (1) Assessed belief in their competence, performance, and patient outcomes; (2) rated impact in specific skill areas; (3) listed differences they intended to make upon returning to practice; (4) listed barriers they perceived would limit their ability to effect positive changes, and (5) whether they had learned the material, and their reaction to the course. Reported here are the results for pharmacists across the 4 modules.

Results: In 2012-2013, 2,457 HCPs participated in different DGR modules; 417 self-identified as pharmacists; 385 RPh claimed credit. Overall pharmacist program learner satisfaction (n=360) was 4.75 on a 5-point Likert scale. Pharmacists stated activity participation changed their knowledge/attitudes (Likert rating 4.31, n=367); content covered was useful/relevant to practice (Likert rating 4.48, n=368) information learned during this activity would be helpful in improving clinical skills/judgment within the next 6 months (Likert rating 4.32, n=366) Areas of

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improvements reported by pharmacists at learning event: Module A: Addressing Hyperglycemia in the Inpatient Setting: Whys and Hows (n=71): Improved competence reported by 73% of pharmacists participating, improved performance by 49%, improved patient outcomes 52%; Module B: Multidisciplinary Approach in Developing/Implementing Insulin Protocols (n=55): improved competence reported by 73%;, improved performance by 53%, improved patient outcomes by 56%; Module C: Optimizing Care: Case Studies: improved competence reported by 71%; improved performance by 51%; improved patient outcomes by 48%. For the pharmacy-specific module the results were: improved competence 72%; improved performance 41%; improved patient outcomes 41%. At least one barrier to implementation was reported by 56% of pharmacists (n= 380); the top 5 being: time (24%); protocols (19%); coordination (18%); administrative (12%); resistance to change (12%).

Conclusion: Improving inpatient hyperglycemia control and reducing hypoglycemia risks requires a multidisciplinary team, of which pharmacists are integral team members. An impact analysis of this CE program designed to improve inpatient hyperglycemia management and understand barriers to implementation was conducted. Pharmacists were eligible to participate in 3 modules with other team members, as well as participate in a module designed exclusively for them. Analysis results showed learner satisfaction, changes in knowledge/attitudes, relevance to practice, information would help improve skills/judgment, and either confirmed current practice or showed intention to change practice (data not shown). Substantial barriers to change still exist.

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4-052

Category: Drug-Use Evaluation

Title: Assessment of acetylsalicylic acid use in Lebanese population

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Purpose: Atherosclerosis, the most frequent underlying cause of cardiovascular diseases, can be prevented by controlling the modifiable risk factors. The therapeutic plan for atherosclerosis should include pharmacological and non-pharmacological approaches. Current treatment aims at controlling risk factors and maintaining perfusion in the affected arteries. Antiplatelet therapy has been shown to reduce vascular events where acetylsalicylic acid (ASA) is the most commonly used drug in Lebanon. The purpose of the study is to assess the utilization of ASA in Lebanese adults for primary or secondary cardiovascular disease (CVD) prevention.

Methods: The institutional review board approved this cross sectional prospective study conducted in February 2014 at nine different community pharmacies around Lebanon. An informed consent was obtained from the enrolled participants. A total of 97 patients were studied based on the eligibility criteria which included participants aged 40 to 79 years and resided in Lebanon at the time of the survey. A face to face interview using a questionnaire was conducted to assess ASA utilization. Study data were analyzed by SPSS version 20.0, and descriptive analyses were performed using frequencies and means. The chi-square test was used to determine the association between ASA use and selected variables. Multivariate logistic regression was also performed to predict the relation between the dependent variable, which is aspirin use, and the independent variables that are age, gender, level of education, and location. A two-sided α level of 0.05 was employed to ascertain statistical significance, and 95 percent confidence intervals were reported.

Results: Enrolled subjects have a mean age of 53.11 years, and the number of participants is evenly distributed between genders (53.6 percent are men). Seventeen percent live in rural areas and 83 percent live in urban areas. From the enrolled subjects, only 30 patients (30.9 percent) use ASA. Patients who take ASA are divided into users for primary CVD prevention (50 percent), secondary CVD prevention (33 percent), and analgesia purposes (17 percent). Seventy nine percent of ASA users started it on physicians advice, and 55 percent believe that ASA benefits outweigh its risks. Two percent reported the use of clopidogrel along with ASA. There is a significant association between gender and ASA use (P less than 0.001). Logistic regression models show that males take ASA 4.544 times more than females (P equals 0.022). The other independent variables including age, level of education and location show no significant relation with ASA use.

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Conclusion: There is an evidence of ASA under-utilization between Lebanese adults. This exposes high risk people to the hazard for the occurrence of first event of myocardial infarction and stroke. This study revealed a strong association between aspirin utilization and male gender which is not a surprise as male gender is a risk factor for CVD that predisposes them to cardiac problems requiring an antiplatelet agent. There is a need for more efforts by health care professionals to highlight the importance of ASA as an antiplatelet agent in CVD prevention among high risk individuals.

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4-053

Category: Drug-Use Evaluation

Title: Evaluating hyperglycemic events with usage of intravenous corticosteroids in a community hospital setting

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Purpose: It is well documented that the administration of high dose corticosteroids can stimulate gluconeogenesis. Specifically, methylprednisolone can cause significant rises in post prandial blood sugars which may last anywhere from six to twelve hours. This has been seen mostly in patients with comorbid conditions such as diabetes yet may also occur in patients receiving high doses acutely. Consistently elevated blood sugars >180-200mg/dl can increase morbidity and mortality in critically ill patients. Therefore, achieving greater glycemic control should be emphasized in hospitalized patients with vigilant blood glucose monitoring. This study aims to evaluate glycemic control in critically ill patients on intravenous methylprednisolone. St. Josephs Wayne Hospital is a 220-bed geriatric niche community hospital.

Methods: A computer generated report from July 2013 to February 2014 was obtained of patients treated with intravenous methylprednisolone. Patients were included if they received a minimum of two days of methylprednisolone therapy. Some of the patients admitted were repeat admissions but each admission was treated as a separate visit. The average age of the patient population was 72 years (ages ranged from 21-95). Sixty-eight visits were evaluated, sixty-six percent of which were female (n=46). Patients were divided into two groups those who had three or more elevated blood glucose levels of 180 mg/dl or higher, and those who had less than 180mg /dl during their course of treatment. Patients were categorized based on the treatment received (sliding scale insulin alone, standing orders of insulin, and a combination of both) or none at all.

Results: Fifty percent of the visits were diabetics (n=16) and experienced blood glucose levels above 180 mg/dl during their treatment with methylprednisolone. Thirty-two visits showed patients with frequently elevated blood sugar elevations above 180 mg/dl. Of these, 94% (n=30) were administered insulin therapy. Fifty-six percent (n=18) of the patients visits received sliding scale insulin coverage alone, while 37.5 % (n=12) received sliding scale coverage and standing orders of insulin. Thirty-four (50%) of all the admissions surveyed received no insulin treatment intervention during their hospitalization. Six percent (n=2) were among the group who had experienced hyperglycemic events greater than 180 mg/dl.

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Conclusion: Hyperglycemic events may be reduced with the addition of sliding scale insulin coverage on patients receiving two consecutive days or greater than five consecutive doses of intravenous methylprednisolone. A performance improvement initiative can be utilized to study glycemic elevations while on methylprednisolone. A limitation that may have occurred is the sample size selected was small. Pharmacists can intervene by checking blood glucose levels and calling the healthcare practitioner with this suggestion of adding sliding scale insulin coverage in effort to reduce exacerbations of blood glucose levels while on corticosteroids. This intervention may serve to improve patient care, while minimizing exacerbations of acute conditions, decrease morbidity and mortality and strengthen interdisciplinary relationships. Blood glucose monitoring for specific at risk patient populations may become incorporated into the decentralized pharmacists responsibilities.

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4-054

Category: Drug-Use Evaluation

Title: Impact of tranexamic acid in total knee and total hip replacement

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Purpose: Tranexamic acid (TXA) is an antifibrinolytic used to reduce blood loss during surgical procedures. Several small studies have demonstrate no increased risk of venous thromboembolism (VTE) in patients who have received TXA in total knee or total hip replacement (TKR or THR). Other studies have demonstrated decreased need for transfusion and decreased blood loss with TXA administration. To date, no studies have compared the net clinical benefit (lack of bleed or VTE) with TXA use in TKR or THR. The purpose of this study was to evaluate the net clinical benefit of TXA administered to patients undergoing TKR or THR.

Methods: An IRB approved retrospective chart review was performed to evaluate the net clinical benefit of TXA use in patients undergoing elective TKR or THR. Patients were included if they were admitted to UHGMC undergoing TKR or THR between January 1, 2012 and December 31, 2013. Patients given TXA for reasons other than TKR or THR, known history of VTE or coagulopathy, serum creatinine > 1.5 mg/dL, or use of antiplatelet agents within 7 days prior to surgery were excluded. Data collected included: baseline demographics (age, gender, BMI, type of surgery, history of atrial fibrillation/malignancy, appropriate anticoagulation and Charlson comorbidity score), number of VTEs, hemoglobin and hematocrit values throughout hospitalization, and number of transfusions. The primary outcome was the net clinical benefit of TXA use. Secondary outcomes included length of stay (LOS), incidence of VTE during hospitalization and at 1 month, change in hemoglobin, and number of units of blood transfused.

Results: This chart review evaluated 406 patients with 327 patients meeting inclusion criteria. Of those, 174 patients received TXA vs. 153 patients who received no treatment. The majority of patients in this study were male (58%, 60% respectively, $p=0.70$) with an average age of 66.9 years, and an average BMI of 32.7. Average Charlson comorbidity scores were higher in the group of patients not receiving TXA (3.27 vs 2.72, $p=0.003$). TXA demonstrated a positive net clinical benefit (40.8 % vs 13.7 %, $p<0.001$) but did not affect LOS (3.39 vs 3.36 days, $p=0.71$). Incidence of VTE was comparable between groups (2% vs 1%, $p=0.27$). Average change in hemoglobin was significantly higher in the group not receiving TXA (-4.26 mg/dL vs. -3.46 mg/dL, $p<0.001$) and this group also had a lower proportion of patients requiring blood transfusions (7% vs 24%, $p<0.001$).

Conclusion: When given pre- and peri-operatively to TKR and THR patients, TXA demonstrated a significant benefit in decreasing change in hemoglobin as well as the need for

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blood transfusion. No increase in the incidence of VTE was seen with the use of TXA in this patient population.

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4-055

Category: Drug-Use Evaluation

Title: Intravenous acetaminophen after orthopedic surgery: medication-use evaluation

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Purpose: The intravenous formulation of acetaminophen (IV APAP) was approved by the FDA in November of 2010 for the management of pain and fever reduction. Since IV APAP was approved on a limited basis by the Pharmacy and Therapeutics Committee at our institution in December 2011, its use has expanded and it is now routinely prescribed by orthopedic surgeons for pain control following knee and hip replacement surgeries. This study will help identify if there has been a benefit to patients who underwent orthopedic surgery (OS) and were administered IV APAP.

Methods: After approval from the Institutional Review Board, a retrospective chart review of orthopedic surgery patients hospitalized from January 1, 2010 to December 31, 2013 was conducted to determine total opioid consumption in the 24 hour post-operative period and length of stay (LOS) following surgery. These co-primary outcomes were compared between patients who received IV APAP and those who did not. Opioid consumption was reported as intravenous morphine equivalents in milligrams, after dose conversions using a standardized table. Length of stay was measured in hours. Only patients between the ages of 18-89 were included in the study, and patients who were treated with PCA pumps and continuous opioid infusions were excluded from evaluation. All comparisons were done using descriptive statistics and appropriate statistical tests for data type.

Results: In total, 200 patient's records were evaluated in this study, 100 in each group. Baseline characteristics were similar between groups in terms of gender ($p = 0.29$), age ($p = 0.96$), surgery type ($p = 0.09$), and concurrent use of liposomal bupivacaine ($p = 0.06$). The mean opioid dose over 24 hours was lower in the IV APAP group than in the NO IV APAP group (12.31 mg vs. 15.16 mg, $p = 0.02$). The mean length of stay in hours was similar between the IV APAP group and the no IV APAP group (79.24 hr vs. 83.34 hr, $p = 0.20$). There was a higher percentage of patients in the IV APAP group who did not receive any opioid medications during the first 24 hours post-operatively as compared to the NO IV APAP group (35% vs. 18%, $p = 0.01$) however, the clinical significance of both the mean opioid dose and the opioid free first post-operative day is unknown since the mean LOS in both groups was > 72 hours.

Conclusion: Patients treated with IV APAP after knee arthroplasty required less opioids in the 24 hour post-operative period, but did not have reduced LOS. Though statistical significance was met for the difference in opioid utilization, this finding does not represent a clinically significant difference, and is not a valid justification for further expansion of its use at our institution. Based

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on the results of this study, IV APAP utilization will be scrutinized for further restrictions on use. Future research on this topic at our institution should include pain score comparisons and address differences in the number of peri-operative IV APAP doses.

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4-056

Category: Drug-Use Evaluation

Title: Assessment of orlistat use among young Lebanese population

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Purpose: There is an increasing concern about overweight and obesity in young people. As well, surveys have demonstrated a marked increase in the utilization of weight loss products in young people of both genders. Orlistat is being frequently used, with or without a prescription, to aid in losing weight. However, because of the availability of this product over the counter, it is being misused by many individuals, particularly the young ones. The purpose of this study was to assess the utilization of orlistat in the young Lebanese community.

Methods: This prospective study was conducted in ten Lebanese community pharmacies. Males and females aged between 18 and 25 years old, who were purchasing any brand of orlistat, were asked to fill a survey. The survey assessed their body weight, height, and BMI. As well, it assessed the history of their orlistat use, dose, frequency, and dietary considerations with the drug use, as well as other supplements and medications they are taking. Individuals who do not know their body weight or height were excluded. 140 individuals were screened over a period of 1 year, where 100 have met the eligibility criteria and were observed. The primary outcome measure was assessment of the percentage of young Lebanese individuals who are candidate to use orlistat. Secondary outcomes included assessment of the drug use with respect to meals and other medications. Data are expressed as frequencies, and evaluation of primary and secondary outcomes utilized analysis of chi-square.

Results: Most individuals on orlistat were found to have a normal body weight (72 percent), versus 15 percent overweight, 10 percent obese, and 3 percent very obese. Similarly, the majority of them (86 percent) were using the drug without considering initial lifestyle changes in terms of dietary modifications and physical activity. For the secondary outcomes, 66 percent of the assessed population was found not to skip the orlistat dose in spite of skipping a fat-containing meal. None of the assessed individuals were taking concurrent medications which absorption may be influenced by the use of orlistat.

Conclusion: Orlistat is being frequently used by the young Lebanese population to lose weight, despite the fact that the majority of the population is not candidate to use it. As well, young people were found to have the tendency to use medications to lose weight without trying to modify their lifestyle first. Similarly, most orlistat users do not have all the necessary information on the correct use of the drug with respect to meals. Therefore, the young community should be further counseled about the benefits and risks of using orlistat, and about

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the correct way of using it; as well as on the importance of lifestyle changes as a cornerstone to lose and maintain body weight.

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4-057

Category: Drug-Use Evaluation

Title: Omalizumab efficacy in reducing corticosteroid use and reducing emergency-department visits, and its impact on treatment costs in patients with moderate to severe persistent asthma

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Purpose: Patients with severe persistent asthma (NAEPP guidelines, steps 5-6), will be on high doses of inhaled corticosteroids (ICS) and may also be on oral corticosteroids (OCS). They usually repetitively visit emergency departments (ED) because of asthma exacerbations. Omalizumab, a monoclonal anti-immunoglobulin E (anti-IgE), is more expensive than other asthma medications and is recommended as an alternative treatment for patients with moderate to severe persistent asthma. Our research aims to study Omalizumab efficacy. The main objectives will be evaluating its effectiveness in reducing the corticosteroids needs and reducing ED visits. A secondary objective will be evaluating Omalizumab impact on treatment costs.

Methods: We conducted a retrospective study. All asthmatic patients treated with Omalizumab since 2009 (the date of approval of the use of Omalizumab at Hamad General Hospital (HGH) Qatar and AlKhor Northern Hospital (NH) Qatar), till September 2013, will be evaluated and their files will be reviewed. The study population was suspected to be small and limited in number, because of Omalizumab cost and because NAEPP and GINA guidelines recommend Omalizumab for a certain limited criteria of asthma patients. Records of the date of initiation of Omalizumab treatment (DIOT), use of other asthma medications especially corticosteroids before and after treatment with Omalizumab, and the emergency department (ED) visits following an exacerbation before and after this anti-IgE medication, will all be recorded on a data collection form. Moreover, treatment costs before and after this anti-IgE medication will also be recorded.

Results: 32 patients (males to females, 43.75% to 56.25%, mean age at DIOT was 39.16 years) were retrospectively studied. Post Omalizumab treatment showed significant reduction in ICS consumption, the mean annual beclomethasone-equivalent daily dose, pre-Omalizumab versus post-Omalizumab was 722.25mcg versus 351.3mcg respectively, $P < 0.001$). 34.4% of the patients stopped ICS post Omalizumab treatment and 25% had a reduction in the ICS dose. OCS for most of the patients was directly associated to their ED visits (i.e exacerbations), which in turn has shown to be reduced significantly. The mean ED visits 1 year Pre versus 1 year post, was 4 to 1, $P < 0.001$) and there was a 21.9% increase in the number of patients with zero ED visits 1 year post-Omalizumab treatment. As for the treatment costs, in our study these costs were directly associated to the ED visits and to the costs of the outpatients asthma-medications. Although Omalizumab is more expensive than other asthma medications and it obviously

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increases the costs of the outpatients asthma-medications, but still the reduction in the annual ED visits reduced treatment costs by 54.2%.

Conclusion: Our retrospective study has shown that Omalizumab can be recommended as an add-on therapy for patients with moderate to severe asthma in order to reduce corticosteroids burden, ED visits and consequently treatment costs will also be reduced.

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4-058

Category: Drug-Use Evaluation

Title: Evaluation of tigecycline utilization at a large, non-teaching hospital

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Purpose: Tigecycline is an antibiotic indicated for community-acquired pneumonia, intra-abdominal infections, and bacterial skin and skin structure infections (bSSSI) in patients 18 years and older. Based on a meta-analysis finding an increase in all-cause mortality associated with tigecycline, the FDA issued a black box warning suggesting the restriction of tigecycline to situations where no therapeutic alternative is suitable. The purpose of this drug utilization evaluation is to assess the ordering patterns for tigecycline at a large, non-teaching (hospitalist-based) medical center. This review will provide insights into potential areas of staff education or formulary restriction of tigecycline to ensure safe, appropriate use.

Methods: This retrospective cohort study enrolled inpatients with orders for tigecycline from September 1st, 2013 through February 28th, 2014. Through retrospective chart review, and a predefined data collection form, adherence to local policies regarding the therapeutically appropriate utilization of tigecycline was assessed. Individual, patient-level data, including: age, site of infection, admit diagnosis, ordering physician, other antimicrobial agents, duration of therapy and patient outcomes were collected through progress notes, laboratory values, and microbiology cultures. Individual reviewers assessed appropriate therapeutic use in this review based on the following criteria: a positive culture for Vancomycin Resistant Enterococcus (VRE) not in urine or blood, documented history of VRE infection, or failure of multiple previous antibiotic regimens.

Results: During the time period analyzed the average daily census consisted of 169 patients, with 16 unique patients receiving inpatient orders for tigecycline. The average duration of overall antibiotic therapy was 15.8 days; with a range of 1-41 days. Duration of tigecycline therapy averaged 5.3 days, with a range 1-23 days and a mode of 2 days. Four patients (25%) had a positive VRE culture, but only 3 of the 16 (18.8%) patients treated with tigecycline met predefined appropriate use criteria. All 3 patients had polymicrobial VRE bSSSI infections. However, alternative VRE active agents were not trialed in 2 of the 3 patients. From that same group, 13 of the 16 (81.2%) patients did not meet the predefined appropriate use criteria. In 10 of the 13 (76.9%) cases where tigecycline was used inappropriately, alternative therapeutic options were available (e.g. infection was susceptible to less broad spectrum anti-infective agent). In 2 of the 13 cases (15.4%), tigecycline was started empirically without a documented VRE history. In

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1 case of 13 (7.7%), tigecycline was used for a urinary tract infection (UTI), an improper indication.

Conclusion: Current literature finds the use of tigecycline to be associated with an increased risk of all-cause mortality. Indications for the medication are limited and use should be reserved for situations where alternative treatments are not effective, such as cases of bSSSI VRE with no improvement or confirmed carbapenem resistant enterobacteraciae (CRE). Given the results of this review, further staff education on appropriate indications for tigecycline is required at our institution in order to provide safe, appropriate use.

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4-059

Category: Drug-Use Evaluation

Title: Evaluation of efficacy, safety and budget impact analysis of riociguat for the treatment of pulmonary arterial hypertension: a masshealth perspective

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Purpose: Pulmonary hypertension is a chronic disease affecting all ages and ethnicities. Patients are unable to receive adequate oxygen perfusion due to increased vasoconstriction of pulmonary arteries straining the right ventricle and commonly leading to right ventricular failure. Currently, the disease can be managed with many different vasodilators including diltiazem, bosentan, sildenafil and epoprostenol. Recently, riociguat (Adempas), the pioneer of a new therapeutic class called soluble guanylate cyclase stimulators with a dual mechanism of action, has been approved. This evaluation reviews the clinical, economic, and financial impact of Riociguat from a state payer perspective for the management of pulmonary hypertension.

Methods: Pharmacy students at an academic institution performed an pharmacoeconomic research study on the clinical and economic impact of a novel medication class compared to existing vasodilator therapy for pulmonary hypertension. A search strategy was devised to find primary and secondary sources regarding the utilization of riociguat and currently available standard therapy. Search key terms considered were: pulmonary hypertension, the current treatment options (each of a different pathophysiologic pathway), efficacy, functional endpoints, and various cost analyses. Databases and resources utilized included: clinicaltrials.gov, Cochrane Central, EBSCOhost, Medline, New England Journal of Medicine, OneSearch, PubMed, and Science Direct. Randomized control trials, editorials, and economic evaluations were reviewed and then integrated into an analysis of the impact of the treatment options in the perspective of the state Medicaid program, MassHealth. The patient population was generated using the most recent data on the pulmonary hypertension epidemiology and applied to the MassHealth population. The standard of treatment that patients received followed those identified in comparable clinical trials. A sensitivity analysis was conducted to determine the overall impact of efficacy and financial outcomes of the different treatment modalities compared to riociguat for the management of pulmonary hypertension.

Results: The primary functional endpoints used to evaluate clinical efficacy were exercise capacity and hemodynamic parameters measured through the six-minute walk test (6MWT) and pulmonary vascular resistance (PVR) respectively. Adverse effects were also taken into

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consideration. In terms of administration, riociguat was found to be potentially more advantageous over epoprostenol and bosentan due to the agents oral route and self-limiting side effects. For exercise capacity, riociguat had a 6MWT combined increase of 41 m, bosentan had an increase of 37.7 m and epoprostenol had an average increase of 32 m. For PVR, riociguat had a combined mean decrease of 236 dynsec^{cm}⁵, bosentan with combined mean decrease of 443.5 dynsec^{cm}⁵, and epoprostenol had a decrease of 3.4 to 5 mmHg/L/min from baseline. All results were found to be statistically significant. Currently, there are no economic evaluations involving riociguat. The novel drug was found to be significantly more expensive compared to diltiazem used for WHO Class I and epoprostenol for WHO Class IV from a MassHealth budget perspective.

Conclusion: This budget impact analysis evaluates the clinical and economic relevance of riociguat from the MassHealth perspective. Although there is no economic evidence, this novel vasodilator is clinically significant in terms of functional development including 6MWT, PVR, and WHO functional class improvement. The BIA demonstrated that riociguat is more expensive compared to other vasodilators utilized in practice. While the clinical viewpoint shows promising results for patients with pulmonary hypertension, the costly economic standpoint makes it difficult to be implemented by payers like MassHealth. Additional data is needed to clarify the future potential of riociguat for this progressive disease.

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4-060

Category: Drug-Use Evaluation

Title: Antibiotic consumption expressed in defined daily doses per 100 bed-days in a non-teaching Lebanese hospital

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Purpose: Increasing levels in bacterial antibiotic resistance have renewed interest in obtaining relevant antibiotic consumption data, especially from hospitals. As recommended by the World Health Organization (WHO), hospital antibiotic consumption is reported as a number of defined daily doses per 100 bed-days (DDD/100 bed-days). For a specific drug, the DDD corresponds to the assumed average daily dose for its main indication in adults. In order to assess the antibiotic consumption in a non-teaching Lebanese hospital, the pharmacy department collected data to identify and quantify the utilization rate of antibacterial agents for systemic use.

Methods: The pharmacy and therapeutics committee approved this descriptive project and ran a data collection over 3 years from 2011 to 2013. The hospital includes 127 beds with an occupancy rate of 51% (average for 3 consecutive years) and has an intensive care, oncology, and internal medicine/surgery units. There are 10 beds in the intensive care unit (ICU) with an occupancy rate of 79% (2011), 75% (2012), and 65% (2013). All medical charts were screened retrospectively and data entry was done by individual antimicrobial agent and route of administration using the European Society of Clinical Microbiology and Infectious Diseases Antibiotic Consumption Calculator (ESCMID ABC Calc) version 3.1. ABC Calc is a simple computer tool used to measure antibiotic consumption in hospitals and hospital wards. It transforms aggregated data provided by hospital pharmacies (generally as a number of packages or vials) into meaningful antibiotic utilization rates expressed in DDD/100 bed-days.

Results: The total antibiotic use during the study period was 89.1 DDD/100 bed days (2011), 90.8 DDD/100 bed days (2012), and 76.3 DDD/100 bed days (2013). The top five antibiotics used were amoxicillin/clavulanic acid, ceftriaxone, cefazolin, levofloxacin and metronidazole. The consumption of broad-spectrum antibiotics including fourth generation cephalosporins (J01DE), carbapenems (J01DH), glycopeptides (J01XA) and extended spectrum penicillins (J01CA) was 16 DDD/100 bed-days (2011), 14.5 DDD/100 bed-days (2012), and 14.8 DDD/100 bed-days (2013). This correlates with the findings of the percentage consumption of antibiotics in the ICU as compared to all the other units, which was 46% (2011), 30% (2012), and 35% (2013). While comparing our findings with international references, it has been noted that the numbers are similar to those of the United States (2002-2003) that scored 79 DDD/100 bed-days and Denmark (2004 2011) that maintained 58-91 DDD/100 bed days. However it was higher

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than other European countries including France, Germany, the Netherlands, and Sweden. The lack of an antibiogram and the length of hospital stay constitute the major limitations of our study. Moreover, it is almost impossible for the hospital to benchmark its consumption with other medical centers that are similar in size, affiliation, and patient cases. Besides, very few data on antibiotic consumption are published in the literature and they are reported using various measurement units.

Conclusion: Consumption statistics of antibiotics can help in tracking the prescribing trends and explaining resistance patterns that permit benchmarking comparisons at healthcare facilities. This study shows the importance of implementing rigid antimicrobial stewardship guidelines in medical centers in order to rectify the evidence of overuse and misuse of those agents. The role of the clinical pharmacist in such programs remains crucial for better patient outcomes.

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4-061

Category: Drug-Use Evaluation

Title: Evaluation of hypoglycemic event rates and hypoglycemic protocol adherence in association with insulin and anti-diabetic medication orders

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Purpose: Hypoglycemia, defined as a blood sugar less than 70mg/dL by the ADA, is associated with increased morbidity and mortality. To decrease the incidence of hypoglycemia and its sequelae, a hypoglycemia protocol was implemented specifically in non-critically ill patients. The protocol detailed treatment for blood sugar less than 70mg/dL with appropriate follow-up every 15 minutes until euglycemia. The purpose of this study is to identify the rate of hypoglycemic events throughout the different levels of care, adherence to protocol, determine risk factors specific to this facility, and pinpoint performance improvement opportunities.

Methods: A computer generated report of patients admitted to St Josephs Wayne Hospital, a geriatric niche community hospital, during January 2014-March 2014 was obtained. Patients were included if at least 1 day during admission was in the critical care unit. Patients were excluded if no blood glucose level were reported and if admissions were longer than 2 months. All blood sugars less than 70mg/dL were recorded along with the time and date. Blood glucose levels drawn immediately post the hypoglycemic event were also recorded along with date and time. A maximum of 27 events were recorded per patient admission. Other information collected included presence of sliding scale insulin (SSI) coverage, basal-bolus insulin coverage, dextrose 50%/50ml use, corticosteroid administration, any anti-diabetic medication and length of stay in the critical care during admission.

Results: One-hundred sixty patients were included in the study. One-hundred twenty-three patients (77%) had no episodes of hypoglycemia. Thirty-seven (23%) patients had a blood glucose level less than 70mg/dL at least once during admission. Of the 37 patients who experienced a hypoglycemic event, 13 were on SSI, 17 were on SSI and basal insulin, 7 had no insulin therapy prescribed. Fifteen of the 37 patients were on corticosteroid therapy, 3 were on an anti-diabetic medication that could cause hypoglycemia, and none had standing orders for as needed dextrose 50%/50ml. Altogether there were 169 recorded hypoglycemic events 27 of which are considered severe hypoglycemia (BS less than 40mg/dL). This equated to a rate of 3.8 events per 1000 patient days. Of the 169 events, 130 did not attain a blood sugar greater than 70mg/dL within 30 minutes of initial event, and only 34 events were retested within the

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recommended 15 minute window. The range of hypoglycemia was 13-69mg/dL. One-hundred ten hypoglycemic events occurred in the critical care setting.

Conclusion: Timely communication of critical lab values is imperative. Results are going to be presented to nursing departments to improve communication of critical lab values (designee or advances in technology). Thorough documentation of responses to critically low blood sugars will be reiterated. SSI order sets will be adjusted. Education regarding hypoglycemia, morbidity associated with SSI orders, hypoglycemic protocol, and precise documentation of interventions will be ongoing throughout the levels of care. Updating the protocol to include critical care and adding the option for dextrose infusions to patients at risk for recurrent hypoglycemia will be considered.

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Professional Poster Abstract

4-062

Category: Drug-Use Evaluation

Title: Implementation of a clinical decision support system and its impact on alvimopan usage in a community hospital: two-year follow-up analysis

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

Methods: Within a Cerner-based electronic medical record (EMR), a CDSS was designed and implemented within a health system to assist physicians in determining whether a patient is a candidate for alvimopan therapy. System-approved criteria are based on FDA-approved indications and limited to use in patients that: 1) scheduled for laparotomy for a partial bowel resection; 2) have not taken opioids for more than seven consecutive days immediately prior to therapy; 3) do not have severe hepatic impairment; 4) do not have end stage renal disease; 5) are not undergoing surgery for complete bowel obstruction. A retrospective medication utilization evaluation (MUE) for alvimopan was performed at a 214 bed community hospital to evaluate the impact of the CDSS. All patients who received alvimopan in 2013 were reviewed. Data included the five CDSS criteria, whether the patient received the manufacture recommended pre-operative dose, and if the drug was discontinued after the patients first post-surgery bowel movement or a maximum of 15 total doses. If patients were not appropriately discontinued after their first bowel movement, the amount of additional doses was evaluated. Finally, the 2013 MUE was compared against the 2011 MUE to determine the effectiveness of the previous recommendations for improvement in compliance.

Results: A total of 30 patients were included in the 2-year follow up MUE (vs. 24 patients in 2011). A total of 27 (90%) of the 30 patients met all 5 of the specified CDSS criteria. One out of 30 patients (3.3%) received alvimopan despite taking chronic opioid therapy at home (vs. 1 out of 24 patients in 2011). All patients (30 out of 30) received a pre-operative dose in the follow-up MUE (vs. 4 out of 24 (16.6%) did not in 2011). Lastly, 13 out of 30 patients (43.3%) were inappropriately administered doses after first bowel movement was noted. On average, these patients received 1.5 extra doses after the first bowel movement with a range between 1 and 3 doses (vs. 79%, 1.3 and 1-3 in 2011 respectively).

Conclusion: Our results suggest that a proactive, CDSS can be successfully implemented using a CPOE-based EMR in the community hospital setting. This technology has the potential to impact

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the prescribing habits of hospital practitioners that is sustainable over time. Moreover, a CDDS could potentially decrease hospital expenditures of high-cost medications.

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4-063

Category: Drug-Use Evaluation

Title: Use of metformin in patients undergoing radiologic studies involving intravenous iodinated contrast media: evaluating compliance with the black box warning

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Purpose: Metformin black box warning (BBW) states that the drug should be temporarily discontinued prior to radiologic studies involving intravenous (IV) iodinated contrast media because of the risk of developing lactic acidosis secondary to contrast-induced nephropathy (CIN). The BBW also recommends that metformin be withheld for 48 hours post-procedure, and reinstated only after renal function is normal. The purpose of this study was to quantify the compliance rate of prescribers in following the metformin BBW in patients undergoing radiologic studies using IV iodinated contrast media, and secondarily to determine the incidence of patients developing CIN and/or lactic acidosis.

Methods: This was a retrospective cohort study involving inpatients of an acute care hospital from July through December 2013. The inclusion criteria were adult patients over 18 years old who underwent computed tomography (CT) studies involving IV iodinated contrast media, and who were on metformin at the time of procedures. The exclusion criteria were CT studies terminated for any reason, or metformin discontinued prior to and not resumed after the procedure. Metformin doses were individualized at the discretion of the prescribers. IV contrast media type and dose were administered per approved protocol. The primary endpoint was the rate of prescriber adherence to metformin BBW. Secondary endpoints were: 1) the number of patients who developed CIN, defined as an increase in serum creatinine levels by more than 0.5 mg/dL or 25 percent compared to the baseline within 3 days of IV contrast administration and not directly linked to other etiologies, and 2) the number of patients who developed lactic acidosis attributable to metformin as determined by clinicians. Patients at high risk for developing CIN and/or metformin-induced lactic acidosis include the elderly, renal or liver dysfunction, alcohol abuse, cardiac failure, muscle ischemia, and sepsis. This study was approved by the Research Advisory Committee.

Results: There were 27 patients who underwent a total of 33 CT studies involving IV iodinated contrast media. The average age was 64.4 plus/minus 16.6 years (range, 27 to 91 years). Overall, metformin was held in 10 studies (30.3 percent) and was continued in 23 studies (69.7 percent). The average number of days held was 3.8 days (95 percent confidence interval, 2.2 to 5.4). In elderly patients, metformin was held in 3 studies (15.8 percent) and was continued in 16 studies (84.2 percent). In patients with comorbidities at high risk for lactic acidosis, metformin was held in 7 studies (33.3 percent) and was continued in 14 studies (66.7 percent). The average baseline

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serum creatinine level was 0.927 plus/minus 0.265 mg/dL. There was one study with no serum creatinine level ordered and 4 studies with no post-procedure serum creatinine levels ordered. An increase in serum creatinine levels consistent with CIN occurred in 3 CT studies (9.1 percent) in 3 patients. Two of these patients were elderly and had one or more comorbidities. Only one of these patients had metformin held in accordance with BBW. However, there were no reported cases of metformin-induced lactic acidosis.

Conclusion: Prescribers did not consistently follow the metformin black box warning to temporarily discontinue the drug in patients who underwent radiologic studies involving IV iodinated contrast media. Although there were no reported cases of metformin-induced lactic acidosis, contrast-induced nephropathy did occur, increasing the risk for this serious metformin adverse effect in this patient population. Pharmacists can play a significant role by educating prescribers about the need to adhere to metformin black box warning, and screening for high risk patients in this setting to improve patient safety.

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4-064

Category: Drug-Use Evaluation

Title: Quality assessment of outcomes associated with Liposomal bupivacaine use in inpatient orthopedic surgeries

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Purpose: Liposomal bupivacaine (LB) is a long acting local anesthetic used for post-surgical analgesia. At Novant Health (NH), LB is approved for inpatient orthopedic procedures comprising total knee/hip arthroplasty, partial knee/hip replacements, and knee/hip revision surgeries. Approval was partially based on results of comparative studies conducted at three NH acute care facilities which demonstrated trends for improved outcomes among orthopedic patients that received intra-operative LB in comparison to patients treated with traditional modalities for pain control. This study assessed utility of inpatient LB use with regard to LOS and direct costs among orthopedic patients and highlighted unapproved usage in non-orthopedic procedures.

Methods: This was a retrospective review of encounter level data to identify patients that had orthopedic surgeries at any NH facility with a subsequent review to identify patients that received LB for post-surgical analgesia. Patients that underwent orthopedic surgeries including total knee arthroplasty, total hip arthroplasty, partial knee and hip replacement, and knee and hip revisions were included in this evaluation. Administrative reports were used to assess outcomes related to length of stay and direct medical costs. In addition, patient charts were reviewed in a sub-analysis of opioid consumption among all orthopedic patients. A secondary evaluation of all patients that received LB during the same time period was also pursued to characterize inpatient usage beyond orthopedic surgeries. Patients in this category were excluded from the primary analysis however; type of surgery and prescriber was noted for purposes of this qualitative review. Patients were included in this study if admission to any NH facility occurred from November 1, 2013 to February 28, 2014 and if the patient had an orthopedic surgery or received LB for post-surgical analgesia. Descriptive and inferential statistics were used for data analysis.

Results: There were 1827 orthopedic surgeries and LB was used in 55% of cases during the time period under review. The majority of patients were female and the average age in the no-LB and LB groups was 64 years and 66 years respectively. Orthopedic surgeries consisted of total knee arthroplasty (65%), total hip arthroplasty (33%), and bilateral joint replacement (2%). The overall average length of stay difference between groups was 4.8 +/- 0 hours. However among orthopedic hip patients in particular, length of stay was significantly lower in the LB group comparatively (2.3 +/- 1.3 days and 2.6 +/- 1.3 days; p=0.02). Length of stay outcomes were highly variable at each facility included in this evaluation. Moderate differences in medical costs were observed between groups (\$1200 less among LB patients); however greater financial penalties were associated with extended length of stay among LB patients compared to no-LB patients (\$4400 more among LB patients). Increased opioid avoidance was observed among LB patients as early as post-operative day one. LB was used appropriately in 91% of all cases

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reviewed, therefore opportunity exists in 9% (and up to 18% at select NH facilities) of cases to improve usage according to institutional guidelines.

Conclusion: LB is reported to produce a prolonged analgesic effect, providing post-surgical pain control for up to 72 hours which should allow for early ambulation and reduced length of hospital stay. Additional strategies are needed in order to ensure that anticipated benefits of LB use among orthopedic patients at NH are realized. In addition, revised operational strategies for dispensing LB at select facilities are needed to ensure appropriate use for approved indications as determined by the NH Corporate Pharmacy and Therapeutics Committee.

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4-065

Category: Drug-Use Evaluation

Title: Reduction in insulin glargine induced hypoglycemia events through a new protocol implementation at small long-term acute care hospital (LTACH)

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Purpose: A medication use evaluation was conducted to evaluate hypoglycemic episodes with the use of insulin glargine, a long-acting insulin analogue indicated for Type 1 and Type 2 diabetes mellitus treatment. Hospitalized patients require special glucose control protocols to avoid severe hypoglycemic events which are associated with higher morbidity and mortality rates. The primary objective was to analyze the effectiveness in managing low blood glucose events with a new protocol. A secondary objective was to compare hypoglycemic events during two different periods. Assessing adherence to the new protocol will be reported and recommendations to improve current documentation are made.

Methods: This study is a retrospective chart review examining all patients with a blood glucose lower than 60mg/dl in June 1st to June 30th, 2013 and below 70mg/dl in March 1st to March 31st, 2014. Inclusion criteria were all patients with an active order of glargine. Patients were excluded if they were on other medications that could significantly cause hypoglycemia (e.g. MAO inhibitors, sulfonylureas, quinine, beta blockers). Adverse drug reaction (ADR) reports and patient charts were used to reconcile data. Primary variable recorded was serum blood glucose after insulin glargine was given. The Pharmacy and Therapeutics Committee modified the protocol from 60mg/dl to 70mg/dl in September 2013 for early detection of hypoglycemic events based on updated ADA guidelines.

Results: 25 patients received insulin glargine during both periods. There were 4 episodes of hypoglycemia during both study periods. Seven hypoglycemic events occurred early in the morning between 4 am and 7:30 am, and one event happened at 11:15 pm. However there was only 1 case of severe hypoglycemia (blood glucose <50mg/dl) in March 2014, compared to 3 incidents in June 2013. This reduced the number of rapid response calls during the night shift. Some changes were made along with the new protocol. Dietician was more involved in meals for diabetic patients, light snacks were given before bedtime, and guideline for patients predisposed to hypoglycemia with risk factors was established.

Conclusion: Based on results of the study, the new protocol has been effective and feasible at our facility for prevention of severe hypoglycemia but did not reduce the total number of events. Detecting hypoglycemia as soon as possible in hospitalized patients can prevent severe

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complications including seizure, loss of consciousness, etc. It may benefit patients in reducing medications use as well as decreasing length of stay at hospital. Proper documentation of fasting blood glucose, MAR alerts on nursing side, and adding dextrose in all insulin order sets were discussed at the Pharmacy and Therapeutics Committee meeting for future improvement.

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4-066

Category: Drug-Use Evaluation

Title: Assessment of the appropriate use of proton pump inhibitors in Lebanese community pharmacies

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Purpose: Proton pump inhibitors (PPIs) are considered a class of safe and very effective pharmaceutical gastrointestinal agents. However, they should only be taken when indicated, because of concerns of potential adverse effects associated with their long term use. In Lebanon, over one hundred and fifteen branded formulations of PPIs are available in community pharmacies, with an inappropriate application of rules on the differentiation between prescription and self medication drugs. In order to assess the possibility of overuse and misuse of PPIs, we conducted this study to evaluate the current utilization of PPIs in community pharmacies in one Lebanese area.

Methods: The institutional review board approved this cross-sectional descriptive study. Community pharmacies from the Bekaa area were randomly selected and were asked to participate in this study. Consequently, pharmacists were well-informed about the data collection sheet and each collected information from twenty consecutive patients and filled the sheets accordingly. Patients who presented to the community pharmacies and were dispensed a PPI were included in the study after receiving an oral informed consent. In addition to socio-demographic information, patients were asked about the source of the PPI prescribed and the perceived or documented indication of use. To assess the appropriateness of the dosing regimen, the participants were inquired about the dose, frequency, duration of use and administration with respect to meals. Also, to determine the presence of drug-drug interactions, patients were requested to list the medications used concurrently. The evaluation of the use of the dispensed PPIs was done based according to the Food and Drug Administration (FDA) approved indications and respective dosing regimens. Statistical analysis was conducted using SPSS version 21.0, chi-square and Fisher exact tests were used when applicable. A P-value of 0.05 was considered statistically significant.

Results: From a total of 384 pharmacies in the Bekaa area, we randomly selected fifty of them and forty agreed to participate in this study. A total number of 454 patients who were dispensed a PPI were surveyed (53.3 % males and 46.7% females). Of these, 43.3% were prescribed by a physician, while 33.3% were prescribed by a pharmacist and 23.3% were self-prescribed. The most commonly used agent was omeprazole (58.1%), followed by lansoprazole (13.2%). All PPI generic names were consumed as prescription and over the counter drugs. 62.3% of the patients were using PPIs in accordance with their FDA approved indications and the remaining 37.7%

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used them inappropriately. The most common appropriate indication (34.1 %) was gastroesophageal reflux disease while lack of diagnosis was the most inappropriate one. Approximately, 52.3% of the patients were taking their medication before meals, while 25.8% were administering them when needed. 50.3% of the patients who were dispensed a PPI prescribed by the pharmacist used a correct administration, compared to 59.4% in the physician group and 41.5% in the self-prescribed group ($p=0.01$). The correct dose and duration were found in 45.6 % and 5.6% of the population respectively. 15.4% were taking concurrent medications with documented interactions with PPIs ($p=0.013$ between study groups).

Conclusion: In the Bekaa area, PPIs are currently being overused and misused, which is documented by the high frequency of inadequate indication and inappropriate dosing regimen. Increased healthcare professionals awareness, on appropriate PPI use will improve drug consumption and patient outcomes. Pharmacists have a great role in patient counseling, given the significant over the counter use of PPIs. More drug utilization and pharmaco-economic studies should be conducted in the future to determine the extent and consequences of improper PPI consumption.

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4-067

Category: Emergency Medicine / Emergency Room

Title: Impact of pharmacist led medication reconciliation at Memorial Hospital Miramar

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Purpose: Evaluate the effectiveness of the pharmacist lead medication reconciliation during admission in the emergency room. To help increase patient safety during transition from home to hospital.

Methods: Patients were identified by emergency room physician for admission. Pharmacist working in the emergency department would visit the patient identified and review home medication patient provided to the triage nurse. Pharmacist was on duty during the hour of 1400 to 2300. All attempts were made to visit that were admitted during the times pharmacist was not present. All anomalies found on patients home medication regimen were identified and corrected by talking to admitting physician.

Results: Pharmacists were able to review patients home medication in Emergency room between 70-65% of the admission (700-500 patient per month). Additional 25-15% of the patients were visited and home medications were reviewed within 24 hours of admission (100-200 patients per month). Remaining 7-5% of the patients were seen and addressed greater than 24 hours from admission (60-20 patients per month). We were also not able to see about 8-4% percent of patient that were admitted (100-40 patients per month). Phramcist lead medication reconciliation lead to corrections on multiple omitted medications, correction of dose, correction of frequency, and removal of incorrect or duplicate medications patients were no longer taking. We were further able to classify it under various category as High Risk medications at Memorial Hospital Miramar, Antihypertensive, Oral hypoglycemic and COPD/Asthma. We would like to share the data in the above category as well.

Conclusion: Pharmacist reconciliation upon admission leads to fewer errors at our facility. Error which would have led to elevation in level of care for the patient, and/or possible short term harm to the patient. It is vital that pharmacist review medications with patients based on disease state and help identify errors before they reach the patient by conducting a thorough medication review at time of admission.

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Professional Poster Abstract

4-068

Category: Emergency Medicine / Emergency Room

Title: Impact of pharmacy extenders on providing emergency medicine pharmacy services

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Purpose: The role of pharmacists in the emergency department (ED) has been a hot topic in recent years, and many institutions are looking to create or expand their emergency medicine pharmacy services. Recent information has shown that pharmacy extenders such as students and technicians can be utilized to obtain accurate medication histories. This project was designed to review the impact provided by these additional personnel in newly expanded roles within the ED as well as to see how their support can impact the services provided by the ED pharmacists themselves.

Methods: Pharmacy interventions and services can be documented and measured using an intervention documenting system within the electronic medical record. Interventions titled as "medication reconciliation" were reviewed during a time period that included ED services provided by the pharmacists alone, the pharmacists and technicians, and the pharmacists, technicians and a student to establish the number of medication histories performed. The types of interventions made by the pharmacist in addition to "medication reconciliation" were also reviewed for these time periods to determine if the additional support allowed the pharmacist to make more interventions related to the essential direct patient care roles provided in guidelines for emergency medicine pharmacy services.

Results: Interventions by ED pharmacy personnel were reviewed for the months January through April 2014. A total of 1,433 interventions were performed during this time period with 88% labeled as "medication reconciliation." During January with only pharmacists in the ED, there were 186 medication histories performed and 30 non-medication history related interventions. Following the placement of technicians into the ED, the medication histories increased to 279 in February and 291 in March, and the non-medication history interventions by pharmacists increased to 40 in February and 43 in March. These figures represent a 50% increase in the number of medication histories recorded by pharmacy personnel and a 33% increase in the non-medication history interventions recorded by pharmacists. Further, a student on an advanced pharmacy practice experience (APPE) rotation additionally raised the medication histories for April to 500, while non-medication history related interventions made by pharmacists increased to 64. Collectively, utilizing technicians and students in the ED resulted in a 169% increase in pharmacy conducted medication histories. Pharmacy extenders also allowed pharmacists to redirect their attention to non-medication history interventions which saw a 113% increase during the study period.

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Conclusion: The use of pharmacy technicians and APPE students in the ED greatly increased the number of medication histories performed, and the additional support provided the ED pharmacists more opportunities to make interventions outside of performing medication histories. This additional help in the medication reconciliation process enhanced the emergency medicine pharmacy services performed at the institution and allowed pharmacists to fulfill more of the essential direct patient care roles attached to these services.

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4-069

Category: Emergency Medicine / Emergency Room

Title: Impact of pharmacist review of positive culture results for patients discharged from emergency departments

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Purpose: Determine whether implementation of clinical pharmacist review of positive culture results for patients discharged from the emergency departments (ED) of a community health system improves the quality of patient care.

Methods: Eligible participants were ≥ 18 , discharged from a Cone Health ED and had an organism result on a culture. This study was performed in two phases. Phase 1 was a retrospective evaluation of 130 patients with cultures obtained in August 2013. Data was collected from electronic medical records and analyzed for opportunities to improve patient care in the prospective phase. The phase 2 prospective intervention and evaluation consisted of implementation of a pharmacist-managed culture review process focused on reducing the time to follow up of the first 100 patients discharged without adequate therapy.

Results: Evaluation of the retrospective cohort revealed a mean time to patient follow up of 3.2 days after final culture result and a significant percentage of inadequately assessed sensitivity data resulting in continued inappropriate therapy. In the 30 days following implementation of the pharmacist-managed ED positive culture review process pharmacists assessed 608 cultures and identified 109 patients who required follow up. Reasons for follow up included to recommend alternative treatment for patients on inadequate therapy (64), to provide laboratory data to primary care providers (13), and to ensure prenatal follow up for 2 pregnant patients. Mean time to patient follow up was decreased to 2.17 days during the prospective phase and peer review showed that sensitivity data was appropriately assessed in all cases.

Conclusion: Pharmacists at Moses H Cone Memorial Hospital modified an existing positive culture review process for patients discharged from health system EDs by implementing pharmacist review of resulted culture data to positively impact patient care.

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4-070

Category: Emergency Medicine / Emergency Room

Title: Alteplase preparation by pharmacy for acute ischemic stroke: a simulation pilot

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Purpose: During an acute ischemic stroke, timely administration of alteplase increases the likelihood of good functional outcome. With each passing minute without recanalization, millions of neurons are lost. Stroke centers have adopted a goal door-to-needle (time to begin intravenous alteplase treatment) of less than 60 minutes. The Joint Commission (TJC) recommends that medications be dispensed in as ready-to-use form as possible. To meet TJC's recommendation, while ensuring safety and timeliness, we launched a simulation pilot for alteplase preparation by pharmacy. The purpose of this simulation was to collect feedback from staff, and utilize the data to assess and improve the process.

Methods: This study was conducted at a 719-bed academic medical center and certified primary stroke center. A worksheet was developed by the neurocritical care clinical pharmacist and the pharmacy supervisor for sterile product preparation outlining pharmacy response following a Code Stroke. The worksheet functioned as a step-by-step outline and required a time stamp for all stages to provide feedback. Time zero was defined as time of pager notification. Specially trained pharmacists monitored and facilitated the simulation and provided staff with pertinent information required for alteplase preparation. During the pilot, preparation of alteplase resumed as per standard hospital processes. The pharmacist responding to the simulation code documented the necessary information on the worksheet, calculated the alteplase dose using our hospital approved stroke calculator. The pharmacist entered information into the electronic system allowing for safety checks, printed paperwork and staged alteplase for preparation. Once confirmation was received, preparation of the simulated product was initiated. All sterile products prepared at our institution follow the department standards for sterile preparation in accordance with USP 797 and are checked by two pharmacists. Finally, pharmacy personnel delivered the simulated product to the emergency department. We collected the time stamps for each step, and compiled the results.

Results: The pilot was conducted over three weeks. Among 40 mock scenarios, the average alteplase processing time by pharmacy, from notification to delivery, was 41 minutes (range 28 to 55 minutes). The rate limiting steps identified were time to worksheet preparation and time to alteplase preparation, with average time of 17 minutes (range 3 to 24 minutes) and 13 minutes (range 5 to 15 minutes) respectively. Some of the barriers we observed involved identification of

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a responsible person for responding to a code stroke, timely notification of code stroke, obtaining pertinent patient information, computer and technical limitations such as printer and labeler malfunction, and preparation barriers (e.g. staff training on this new process). When compared to the hospitals standard (i.e. nursing preparation), pharmacy preparation time was similar in some cases and overall would not have changed the proportion of patients treated within the door-to-needle goal of less than 60 minutes.

Conclusion: Based on the data collected, our current system would require process modification for timely alteplase preparation by pharmacy. We are evaluating our current system for improvement opportunities for minimizing the barriers within our system. Some of the opportunities identified included providing more education and training for the staff and improving communication with the emergency room. We are moving to an enhanced computer system which might resolve the technical issues. Additional simulation trials and data analyses are planned after implementing enhancements to ensure the pharmacy alteplase preparation process is safe and timely prior to implementing this service.

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4-071

Category: Emergency Medicine / Emergency Room

Title: Effectiveness of INR reversal agents within the emergency department for acute major bleeding events

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Purpose: The overall purpose of the study is to compare the efficacy of pfour factor prothrombin complex concentrate (4PCC) and three factor prothrombin complex concentrate (3PCC), when used to treat patients presenting to the emergency department with active major bleeding due to an elevated INR.

Methods: A retrospective chart review of patients receiving 4PCC or 3PCC was performed utilizing the institution's medical record system. Patients who received 4PCC or 3PCC while in the emergency department between April 1, 2013 and April 1, 2014 were included. Patients were excluded if they were pregnant or lactating. IRB approval was obtained from the institution. Age, gender, height, weight, hospital length of stay, baseline international normalized ratio (INR), partial thromboplastin time (PTT), prothrombin time (PT), INR at 1, 6, 12, and 24 hours after administration, post-study drug PTT, post-study drug PT, dosage, number of doses, rate of infusion, warfarin indication, documentation of thrombosis, time from Kcentra, Profilnine, or FFP administration to initial measurement of INR, PTT, and PT were collected. Patients were also assessed for incidence of death, surgery, and thrombosis.

Results: Within the trial, 41 and 25 patients were included in the 4PCC and 3PCC treatment arms, respectively. There was no difference among the baseline characteristics with the exception of age. Patients receiving 3PCC were more likely to be of increased age (71.07 +/- 12.6 vs 77.32 +/- 10.76, $p=0.0437$). Other initial values, including baseline coagulation labs (INR, PT, PTT) showed no statistical difference. 4PCC patients experienced a numerically reversal in bleeding, a 1st repeat INR value mean of 1.45 compared to 1.71 for patients receiving 3PCC ($p=0.0391$).

Conclusion: Patients receiving 4PCC experienced a statistical difference in INR at the time of 1st repeat INR. Despite the difference in numbers, there was no change in net clinical effect; patients continued to experience negative outcomes, such as death, thrombosis or required surgery. The medications have theoretical benefits over fresh frozen plasma and Vitamin K, but additional trials should be conducted to determine the overall value. More specifically researchers need to further compare four factor prothrombin complex concentrate vs three factor prothrombin complex concentrate.

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Professional Poster Abstract

4-072

Category: Emergency Medicine / Emergency Room

Title: Development and implementation of a pharmacist-driven antimicrobial callback program for discharged emergency department patients

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Purpose: The initiation of two pharmacist positions in a level 2 trauma center allowed for the expansion of pharmacy services to include antimicrobial callbacks for discharged Emergency Department (ED) patients. The purpose of this program was to decrease time spent by ED nursing staff that previously were required to review these patients daily, provide a clinical review of patients to assist physicians with follow-up, antimicrobial changes or initiations in therapy, and to create a standardized process for the adult and pediatric ED.

Methods: Initiation of this ED pharmacist program began in September 2013. Data collection occurred for 6 months beginning December 2013 through May 2014. This marked the starting point of a standardized process between both the adult and pediatric ED coinciding with the movement from paper charting to progress notes in the electronic medical record. Positive antimicrobial results were faxed or phoned to the ED daily by microbiology. Antimicrobial results included blood, throat, wound, urine and gonorrhea/chlamydia cultures. After reviewing patients' charts, the ED pharmacist reviewed each result with the appropriate adult or pediatric physician and provided recommendations. Once follow-up and therapy modifications were determined, all patients were contacted. Outpatient providers were contacted as deemed appropriate. Letters with follow-up instructions were sent if patients were unable to be reached within 48 hours or their phone number was invalid.

Results: A total of 348 patients were contacted throughout the 182 day study period averaging approximately 2 callbacks per day. Modifications in therapy occurred with 98 patients. Approximately 91% of pharmacist recommendations were accepted. Letters were sent to 45 patients.

Conclusion: This pharmacist-driven antimicrobial callback program established a standardized process for both the adult and pediatric ED moving from paper charting to the electronic medication record. In addition, this program allowed for an intense review of patients with positive results in order to recommend appropriate follow-up, changes, or initiations of antimicrobial therapy to ED physicians. The high rate of accepted recommendations showed the success of this program.

ASHP 2014 Midyear Clinical Meeting

Professional Poster Abstract

4-073

Category: General Clinical Practice

Title: Multidisciplinary approach to hypoglycemia reduction at an inpatient rehabilitation hospital

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Purpose: Effective in-patient glycemic control is associated with reduced morbidity and mortality and reduced cost to healthcare institutions. Hypoglycemia is a major safety concern with the use of insulin and insulin secretagogues. It is imperative to adjust the antidiabetic medications including insulin when patients are transitioned to a rehabilitation facility from acute care hospital, due to changes in medical management, physical activity and dietary intake. The purpose of this study was to describe the impact of diabetes management protocol implementation, developed by the multidisciplinary task force on the frequency and number of hypoglycemia events in the diabetic patients admitted to the inpatient rehabilitation hospital.

Methods: Multidisciplinary diabetes management task force was formed in November 2012, which included representatives from pharmacy, nursing, nutrition services, physical therapy, information services, quality assurance and medical staff departments. The goal of this task force was to reduce the incidence of hypoglycemia events (HG) by 50%. All blood glucose (BG) measurements were conducted using the Point of care (POC) bedside glucose testing, values from baseline period (April- October 2012) were used for detailed analysis of hypoglycemia events. Hypoglycemia is defined as BG less than 70 mg/dL, and severe HG is defined as BG less than 40 mg/dL. The frequencies of hypoglycemic values were calculated as a percentage of the total number of POC-BG measurements. A dose adjustment protocol was developed to address oral and injectable antidiabetic agents, taking into account patients BG levels as well as carbohydrate intake. The protocol was reviewed and approved by the medical staff. Other strategies implemented for reducing HG events were 1) changing medication administration times from before meals to after meals, 2) changing the goal fasting and random BG ranges and 3) nursing, therapy, pharmacy and medical staff education. Pharmacists were trained to participate in the daily clinical monitoring of diabetic patients. The new protocol was initiated in April 2013 and it was fully implemented by August 2013.

Results: A retrospective review of 544 diabetic patients during baseline period revealed 417 HG events experienced by 134 patients (3.1 HG events per patient) out of which 22 patients (4% of

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544 total patients) experienced severe HG events. Of the total of 20,878 BG measurements analyzed, 2 % were considered HG measurements. In the follow up period (September 2013 March 2014), a review of 496 diabetic patients revealed 185 HG events experienced by 95 patients (1.9 HG events per patient), out of which 5 patients (1% of 496 total patients) experienced severe HG events. Of the total 21,258 BG measurements analyzed, 0.9% were considered HG measurements. Overall results showed a 55% reduction in frequency of HG, 39% reduction in HG events per patient and 75% reduction in number of patients experiencing severe HG events. In the baseline period 24.6 % of diabetic patients (134 out of 544) experienced hypoglycemic events vs. during the follow up period 19% of patients (95 out of 496) experienced hypoglycemic event during their stay. Secondary observations showed an increase in frequency of hyperglycemic measurements with BG > 180 mg/dL. This was a 33% increase from 20.2% during baseline to 26.9 % during follow up period.

Conclusion: The multidisciplinary taskforce was instrumental in developing, implementing and establishing the diabetes management protocol which resulted in a significant reduction in the frequency of hypoglycemic events as well as reduction in the number of hypoglycemic events per patient. Severe hypoglycemic events were reduced by 75% resulting in improved patient safety. Although the incidence of hypoglycemia was reduced there was an increase in number and frequency of hyperglycemic events (BG > 180). Further research needs to be done to identify the cause(s) and address this paradigm shift.

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Professional Poster Abstract

4-074

Category: General Clinical Practice

Title: Utilization of pneumococcal and influenza vaccines among pneumonia patients at academic teaching hospital in Qatar, prospective observational study

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Purpose: To evaluate the immunization pattern of both pneumonia and influenza vaccine in qualified pneumonia patients as recommended per guidelines. We will evaluate vaccination criteria for every patient and evaluate the vaccine administration status for eligible patients. The primary outcome is to assess the adherence of physician to quality core measures in immunizing the qualified patients admitted with the diagnosis of pneumonia. The results of this study will help to improve the adherence to the international guideline of influenza and pneumococcal vaccines. This will help in reducing the rate of hospital admissions and mortality related to influenza and pneumococcal disease.

Methods: Prospective- qualitative survey carried out between May-June 2014. Inclusion criteria: all aged 18 years old patients who admitted to the Hospital with pneumonia diagnosis in the period between May and June 2014 identified by Infectious Disease Society of America and the Centers for Disease Control (CDC) Advisory Committee on Immunization Practices Data will be collected from our pharmacy records, Cerner and eMR viewer and patient file during his hospital admission. Reliability and validation test of tools. Usage of SPSS software - Descriptive statistics (frequencies, percentages, mean standard deviation) will be used.

Results: There were 432 patients met the inclusion criteria for both vaccines; 120 patients (27.5%) were eligible for only influenza vaccine, 12 patients (3%) were eligible for only pneumococcal vaccine and 300 patients (69.5%) were eligible for both vaccines. Age group (60-69 years) was dominant in this study (41.5%). A round half of the patients education level was college or higher. There was no statistically significant difference between influenza and pneumococcal vaccine groups in terms of adherence to vaccination guidelines ($p=0.175$). Around half of patients were indicated for influenza and pneumococcal vaccine and didn't receive the vaccines; 47.1% (198/420), 54.4% (170/312) in influenza and pneumococcal vaccine respectively. Overall, there was insignificant difference in adherence to vaccination guidelines between age groups ($p=0.025$). Low adherence to vaccination guidelines was mostly reported in young age group (18-39 years) for both vaccines. Comparing the vaccination guidelines adherence with education level retrieved no statistical significant difference ($p=0.696$). 69% of those whom received pneumococcal vaccine were after clinical pharmacist

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recommendation. ($p < 0.001$) While 31% of those patients whom received the pneumococcal vaccine were without any clinical pharmacist intervention (spontaneously). For influenza vaccine, 55.4% of those whom received the vaccine were after clinical pharmacist recommendations.

Conclusion: This study highlighted the impotence of more adhere to vaccination guidelines as failure to implement vaccine guidelines for all indicated patients represents a missed opportunity to prevent pneumococcal disease; vaccination is the best way to prevent these diseases. Strategies to improve adherence to Influenza and pneumococcal vaccination guidelines should focus on physicians, nurses and clinical pharmacists. New studies are required to assess the impact of adherence to vaccination guidelines for Influenza and pneumococcal vaccination guidelines. Until that, this study hopefully will be used to better inform healthcare providers, and this eventually translates in to an increase in the awareness and health benefits.

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4-075

Category: General Clinical Practice

Title: Incidence of corticosteroid induced hyperglycemia in hospitalized patients with an acute exacerbation of chronic obstructive pulmonary disease who receive high dose vs. low dose corticosteroids

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Purpose: Current guidelines recommend corticosteroids for treatment of an acute exacerbation of chronic obstructive pulmonary disease (AECOPD) albeit in considerably lower doses than the studies which cemented corticosteroid place in therapy. Corticosteroids are known to carry a significant side effect profile, specifically for hyperglycemia. Whether dose size matters in the incidence of corticosteroid induced hyperglycemia is undetermined. This study was designed to determine if there is an association between corticosteroid dosing and the incidence of corticosteroid induced hyperglycemia in patients with an AECOPD.

Methods: A retrospective review of patients discharged with the primary diagnosis code 491.21/491.22 AECOPD was undertaken in a community hospital following approval of the Institutional Review Committee. For study inclusion patients must have received corticosteroids within the first 24 hours, overall length of stay must have been greater than 48 hours, blood glucose levels must have remained below 180 mg/dl for the first 12 hours of hospitalization without the use of insulin, and more than one glucose value must have been available for assessment. Patients were then divided into tertiles based on the total corticosteroid dosage received on day two of hospitalization. Baseline demographics, comorbidities, home medications, inpatient medications and lab values were assessed using binary logistic regression to compare between tertiles and establish if any differences exist. The primary outcome was to establish if a greater incidence of corticosteroid induced hyperglycemia occurred in hospitalized patients with an AECOPD who receive high vs. low dose corticosteroid therapy. Patients were considered to have experienced hyperglycemia if a blood glucose reading greater than 180 mg/dl occurred or insulin therapy initiation was necessary. Further analysis was undertaken using a cox proportional hazards model to adjust for potential confounders/effect modifiers which were established a priori.

Results: Based on the doses of corticosteroid received patients were divided into three tertiles, those receiving less than 125 mg (tertile one), those receiving 125-187.5 mg (tertile two), and those receiving greater than 187.5 mg (tertile three). The tertiles were not found to differ significantly on any variables, except for hypertension ($p=0.01$) and dextrose in intravenous fluids ($p=0.03$) between tertiles one and three, this included the primary endpoint of corticosteroid induced hyperglycemia. Analysis using the cox proportional hazards model to assess for confounding found significant differences in corticosteroid induced hyperglycemia

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between tertiles one and two (HR 1.68 95%CI (1.02-2.76)) and tertile one and three (HR 1.79 95%CI (1.13-2.84)).

Conclusion: Based on study results larger corticosteroid doses are potentially associated with an increased incidence of corticosteroid induced hyperglycemia. Further study regarding the impact on efficacy of large vs. small corticosteroid doses versus side effects is necessary to fully understand how to apply these results.

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Professional Poster Abstract

4-076

Category: General Clinical Practice

Title: Interventions to improve drug administration by nurses among inpatients: a systematic review

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Purpose: Serious medication administration errors are common in hospitals. Various interventions were developed to help preventing such errors such as bar-code technology. The aim of this systematic review is to study the effect of various interventions in reducing drug administration errors. We focused on the observation technique to evaluate the error rate using the total of opportunities of errors (TOE).

Methods: MEDLINE, EMBASE, the Cochrane Library and reference lists of relevant articles were searched between January 1975 and December 2013, without language restriction. Randomized controlled trials (RCT), controlled before and after studies (CBA), interrupted time series studies and non-randomized controlled trials (non-RCT) were included. Studies evaluating interventions to reduce administration errors using the TOE and defining the number of wrong-time errors were included. Eligible participants were nurses administering drugs to adult or children inpatients. Two reviewers independently assessed studies for eligibility, extracted data and assessed the risk of bias using the suggested risk of bias criteria for EPOC reviews. The main outcome was the error rate without wrong time errors and measured at the study level. Random effects model was used to evaluate the effect of intervention on administration errors.

Results: In total, 7,752 records were identified from electronic database searches and six were included. Four were RCT (including one cross over trial) and two were non-RCT. Interventions concerned professional (n=3) (dedicated medication nurses, interactive CD-ROM program, simulation-based learning), prescription (n=1) (computerised prescribing) and dispensing (n=2) (automated drug dispensing system). For the four RCT, administration errors rate reached 8.8% in the intervention group and 6.1% in the control group. The global OR was 1.2 (IC95%[0.7-2.1]) (p=0.442). There was no difference between intervention and control groups. All studies were subject to a high risk of bias, mostly due to a lack of blinding to outcome assessment against contamination.

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Conclusion: We did not find an effect of interventions on medication administrations errors. But there were only four RCT. More studies with strong methodology design such as RCT are needed to evaluate impact of interventions.

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Professional Poster Abstract

4-077

Category: General Clinical Practice

Title: Characteristics of post-graduate year one (PGY-1) residency applicants at a new school of pharmacy and their attitudes towards a residency preparation elective course

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Purpose: Securing a post-graduate year one (PGY-1) residency is becoming increasingly difficult due to a high level of competition for a limited number of positions. The application process for these positions can be difficult for a student to navigate. A two-credit elective course, "Introduction to Residency Practice," is offered to third professional year (P3) students at the DYouville College School of Pharmacy (DYCSOP), in hopes of improving student preparation for the residency application process. Following the first offering of the course, students were surveyed to determine application result, applicant characteristics and how the course benefited the student in the application process.

Methods: An internet-based survey consisting of 25 questions was sent to all graduating DYCSOP students who applied for a PGY-1 residency position for the 2014-2015 cycle. Demographic data, such as cumulative GPA, number of program applications submitted, number of programs interviewed, number of programs on rank list, and whether and how a residency position was ultimately obtained (i.e., National Matching Service ("Match") versus "Scramble") were collected. Students who completed the residency preparation elective were also presented with statements regarding their opinion of the course, such as: "I feel the residency elective prepared me for the residency application process," and rated these using a five-point Likert scale ranging from strongly disagree to strongly agree. Finally, students were asked to provide suggestions on how to improve the course in the future.

Results: A total of 10 DYCSOP students in the inaugural class of 57 (17.5%) applied for a PGY-1 residency for the 2014-2015 cycle. Of these, 10 (100%) completed the survey. The average number of program applications was 7.7, and the average number of programs interviewed was 3.5 (yield of 45.5%), compared to a national average of approximately 66%. The average number of programs ranked was 3.2 compared to an average national number of 4.1. A total of 7 (70%) of respondents obtained a residency position, 4 (40%) via the "Match" and 3 (30%) via "Scramble," compared to 2014 national rates of 64% for application through the National Matching Service and at best, 14.7% through the "Scramble." Seven students (70%) completed the residency elective course, of which four (57%) obtained residency positions. All 7 students (100%) agreed or strongly agreed that the course improved their confidence at the ASHP Midyear Clinical Meeting, and prepared them for the application process. Six (85.7%) felt that the course improved their confidence at residency interviews, and prepared them for the Match

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process. The most common suggestion made by the students for course improvement was to include a clinical case preparation and/or presentation as part of the course.

Conclusion: Students at DYCSOP applied to and ranked fewer programs versus the national average. Compared to the national average, DYCSOP students had a lower success rate of obtaining a position through the "Match," but a higher success rate at obtaining a position through the "Scramble." The vast majority of students who completed the residency preparation course agreed or strongly agreed that it improved their confidence at the Midyear meeting and residency interviews, and prepared them for both the application and Match process. In future course offerings, a clinical case scenario to be analyzed and presented by course participants will be added.

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4-078

Category: General Clinical Practice

Title: Development of an inpatient glycemic management teaching module at a university hospital

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Purpose: The ADA and AACE recommend that non-ICU patients with diabetes or stress hyperglycemia be managed with a basal bolus insulin regimen, consisting of a long-acting, meal-time and correctional insulin component. In 2012, UAB Hospital implemented a pharmacy consultation for a basal bolus protocol to manage glycemic control in patients on general medicine floors. All pharmacists must go through a basal bolus educational class and complete a training validation in order to perform basal bolus consults. The purpose of this project was to make improvements in the education of pharmacists to enhance glycemic control in non-ICU patients at UAB Hospital.

Methods: The investigational review board approved the use of an online survey to assess pharmacists daily use of the basal bolus protocol. Results from the survey will be utilized to make improvements to the basal bolus class. In addition to classroom materials, an Inpatient Glycemic Control Manual: Basal Bolus Protocol will be authored. This training manual will be utilized by pharmacists to familiarize themselves with the protocol prior to the basal bolus class. The manual will also be made available to all UAB pharmacists for reference. A training competency will be created to assess the pharmacists ability to perform a basal bolus consult. This competency will be completed upon completion of the basal bolus class and will allow the pharmacist to begin performing consults.

Results: Eighty-one pharmacists were requested to participate in the online survey. Forty-three responses were obtained during the two-week survey period. Pertinent findings included data regarding glycemic team consults and overall comfort in using the basal bolus protocol. A comprehensive glycemic control manual was authored. It is a twenty-five page document that reviews diabetes pathophysiology and diagnosis, glycemic team consult criteria, appropriate diet orders, timing of scheduled insulin and protocol initiation and insulin titration. Pharmacists that reviewed this prior to class attendance were much more comfortable practicing case questions. A competency continues to be authored. It will include a fifteen question self-assessment quiz, which will test decentralized pharmacists in their competency of inpatient glycemic management. The basal bolus class now emphasizes more protocol initiation and insulin titration, and less general information regarding diagnosis and pathophysiology. Additionally, pharmacists are now required to review the inpatient glycemic control manual prior to class attendance.

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Conclusion: Glycemic control is a complex and evolving part of inpatient care at UAB Hospital. Efforts must continue to provide education that changes as the basal bolus protocol evolves. Pharmacists knowledge of inpatient glycemic management can improve by providing easily accessible information, facilitating basal bolus protocol use by new pharmacists and demonstrating competency in insulin titration.

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Professional Poster Abstract

4-079

Category: General Clinical Practice

Title: Implementation of a metered dose inhaler common canister protocol in a community medical center

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Purpose: Drug expenditures are an area that is always evaluated as a way to decrease the budget. As a 155-bed, acute care medical center which includes all medical services except burns and transplants, it is important for us to always look for ways to reduce drug spend. The purpose of this project was to reduce drug expenditures, the number of agents on formulary, educate staff on the use of a common canister protocol, and track any potential infection control related issues.

Methods: After an extensive literature review, drug utilization review of our respiratory medications and discussion at our Pharmacy and Therapeutics (P&T) Committee meetings, our Organization decided to implement a common canister protocol throughout our facility. In a two-step process, we modified our Formulary using automatic therapeutic Interchange Programs (T.I.P.s) to accommodate metered dose inhalers which would support this program. Following an evaluation of our historical usage to establish baseline data, nursing, medical, respiratory, infection prevention and pharmacy staff were educated on the new process. Monthly updates on the progress of the program were reported to the P&T Committee to include any obstacles to implementation success and how they were managed, as well as changes in infection control parameters. Pharmacy specifically reported changes in monthly usage and drug expenditure data.

Results: The common canister protocol was approved by the P&T Committee in September 2013. Based on review of purchase data, eighteen different product formulations were being purchased at a cost of approximately \$158,000 for the twelve months prior to the implementation of the protocol. In the eight months since implementation, the number of different products being purchases had been reduced to nine and savings in purchases and reduced inventory has been \$43,281.16. Medication wastage has dropped to almost zero since MDI utilization is being maximized, and patient billing is more accurate since patients are charged per treatment rather than for an entire MDI. No infection control issues have ensued based on the tracking and monitoring by our infection prevention specialists and post-intervention staff compliance emphasizing hand hygiene and canister disinfection continues to be prominent. All staff report improved efficiency and fewer treatment delays since implementation. Improvements in patient education and satisfaction have also been reported as a result of more one-on-one time with a respiratory therapist. Limitations of this protocol could include a lack of specifically sampling the metered dose inhaler (MDI) nozzle for culturing before and after disinfection with an alcohol Prep Pad as well as after treatments were administered.

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Conclusion: Through implementation of a common canister protocol, we were on track to save \$65,000 annually, impacting utilization and reducing the inventory without a change in our infection control patterns. Hospitals should consider this protocol for a cost savings initiative.

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Professional Poster Abstract

4-080

Category: General Clinical Practice

Title: Conversion to the biosimilar tbo-filgrastim as a cost savings initiative in a community medical center

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Purpose: As a 155-bed, acute care medical center with all medical services except burns and transplants, it is important for us to always look for ways to reduce drug spend. Tbo-filgrastim was recently approved by the FDA for reduction in the duration of severe neutropenia with non-myeloid malignancies receiving myelosuppressive anticancer drugs associated with a clinically significant incidence of febrile neutropenia. This biosimilar has no statistical or clinical differences identified in pharmacology, efficacy, toxicity, or immunogenicity when compared to filgrastim with the same dosing. The purpose of this therapeutic interchange program was to reduce drug spend without impacting patient outcomes.

Methods: After an extensive literature and drug utilization review of filgrastim, we discussed the topic of biosimilars with our hematologists and oncologists. These specialists were entirely supportive of these therapeutic alternatives and based on their approval, the Pharmacy and Therapeutics (P&T) Committee at our organization decided to implement a therapeutic interchange program for all filgrastim orders to be automatically changed to tbo-filgrastim by the Pharmacy Department. We were fortunate in the months leading up to approval of this program in that many of the national conferences at which our hematologists and oncologists had attended had a strong focus on biosimilars and tbo-filgrastim. Given their strong interest and understanding, all of these practitioners were unanimous in their support of this initiative. Nursing, medical, and pharmacy staff was educated on the new process and a review of biosimilars was presented at our organizations grand rounds and featured in our monthly pharmacy newsletter. Monthly updates on the progress of the program are reported to the P&T Committee to include any obstacles to implementation success, patient safety concerns and any change to patient outcomes which may be associated with this program. Pharmacy reports on changes in monthly usage and drug expenditure data.

Results: The therapeutic interchange of filgrastim to tbo-filgrastim was approved by the P&T Committee and implemented in January 2014. Based on a review of purchase data, the drug spend on filgrastim was approximately \$95,000 for the twelve months prior to the implementation of the program. In the five months since program implementation, the savings has been approximately \$17,000 compared to the same time period of the previous year and \$29,000 compared to the previous 5 months. This equates to a 52% reduction and 65% reduction

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respectively in the amount of money spent on filgrastim and tbo-filgrastim as a result of selecting the lower cost, biosimilar product. More importantly, our clinicians have reported no changes in patient reactions or outcomes since implementing this program. In addition, the filgrastim product had a price increase of 2.9% for syringes and 6.5% for vials in July 2013 making our recent savings more significant.

Conclusion: By implementing an automatic interchange of filgrastim to tbo-filgrastim, we were able to save \$17,000 compared to the same time period of the previous year and \$29,000 compared to the previous 5 months. This program allows the conversion to the lower cost, biosimilar product without impacting patient outcomes and care. Hospitals should consider this therapeutic interchange program for a cost savings initiative.

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Professional Poster Abstract

4-081

Category: General Clinical Practice

Title: How can clinical pharmacists impact heart failure readmission rates in a multidisciplinary heart failure management clinic located in a semi-rural community?

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Purpose: To design and implement a multidisciplinary Heart Failure Management Clinic (HFMC) that meets the following objectives: reduce inpatient and Emergency Department heart failure related readmissions, provide patients with intense education and self-management skills, promote collaboration between patients and health care providers, connect patients with available community resources, and increase patient, family, and community awareness. The clinic is a transitional bridge from hospital to home for patients being discharged after an acute inpatient stay. It is also an alternative to the Emergency Department for patients with acute decompensated heart failure, as well as an outpatient resource for patients seeking education and tips for managing acute and chronic heart failure. The HFMC's key functions include Medication Reconciliation and Medication Therapy Management by a clinical pharmacist as well as providing intensive patient education.

Methods: A multidisciplinary team was formed to help heart failure patients manage their symptoms and positively impact their quality of life. Team members include Pharmacy, Administration, Educational Services, Information Technology, Nursing, Dietary, Rehabilitation, and the Medical Staff. The initiative resulted in the formation of the HFMC. Patients are referred to the HFMC in one of three ways: automatically upon discharge from an inpatient stay, through the Emergency Department, or by an outpatient provider. Once referred, patients are assessed and triaged by the HFMC Clinical Navigator. They are scheduled for two to ten follow-up visits over a 30 to 90 day time frame. Each patient meets with a clinical pharmacist at least once. Clinical pharmacists are active members of our newly formed HFMC monthly support group. Clinical pharmacist competency training for the HFMC included three hours of CE, one hour in-services on the pathophysiology as well as the pharmacology of HF, medication regimens self-study packages including HF guidelines and handouts, and hands-on clinical experience. The implementation of IV furosemide, dobutamine, and milronone protocols are scheduled for this summer. Pharmacy driven protocols have been approved: oral and IV furosemide dosing protocols, titration protocols for beta blockers, ACE-Is, ARBs, metolazone, and spironolactone.

Results: Improving patient safety and quality of life was the driving force behind this initiative. At the time of writing, data to support the above claim is incomplete, but we know we have

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positively impacted patient care. Between August 2013 and March 2014 there were 136 patients seen in the HFMC for a total of 252 appointments. A pharmacist saw every patient at least once. During this time period, twenty-nine readmissions were prevented because of aggressive interventions. Using the average per visit direct cost of \$4,016 per HF admission, these 29 patients resulted in a cost avoidance of \$116,464. The HFMC readmission rate is 5%. Our hospital's heart failure base line rolling readmission rate for 2013 was 23.4%. Our hospital's based goal for 2014 is 21.8%, and the 2015 goal is 20.8%. Our current rate is 18.2%. In March 2014 (last data available) our readmission rate was 16.5%, almost one-half of the March 2013 rate (32%). The time pharmacists took to prepare for each initial MTM, write a progress note, and document the intervention was greater than expected; however, this time decreased as pharmacists adjusted to the new practice environment. Computer software was developed to assist with pharmacist responsibilities. We use a variety of communication tools to inform and train hospital-wide clinical users and the Medical Staff about our HFMC. Included here are: hospital-wide e-mails, posters, letters, in-services, promotions at Medical Staff meetings, and one-on-one discussions with Medical Staff members.

Conclusion: Clinical pharmacists have made a positive impact on heart failure management in our hospital. We have made a positive impact on patient safety and decreased our heart failure rolling 12 month readmission rate from 23.4% to 18.2%. Although cost savings was not the primary reason for developing the HFMC, it has been a welcome benefit. This program allows our institution to be recognized as a leader in our systems heart failure management initiative and strengthens the hospital's image in the marketplace. The program positions the pharmacy department as an active participant in the development of system-wide HFMC programs. In addition, it has opened opportunities for the future growth of our clinical pharmacy team.

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Professional Poster Abstract

4-082

Category: General Clinical Practice

Title: Pharmacy technicians roles and responsibilities in a new transitions of care service

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Purpose: The purpose of this report is to describe how job responsibilities were created for two pharmacy technicians on an interdisciplinary transitions of care team. On May 1, 2014 a pharmacist and two certified pharmacy technicians were added to an interdisciplinary transitions of care team at a faith based, community, level III trauma center. The team consists of nurses, social work, pastoral care, and dietary and aims to reduce 30-day readmissions in patients diagnosed with heart failure, pneumonia, chronic obstructive pulmonary disease, or myocardial infarction.

Methods: Differential roles of the technicians were determined based on technician skill sets: one technician was responsible for coordination of admission medication reconciliation, and the other for coordination of discharge medications and follow up post discharge. Each day the admission medication reconciliation tech reviews a score report for patients at risk for readmission and selects new patients from this list. Throughout the day, the technician receives email alerts of newly scored patients. When a patient is identified, the technician retrieves the medication reconciliation on file, interviews the patient, screens for medication access issues, and then confirms the list with the outpatient pharmacy. Errors identified are documented and sent to pharmacist for resolution. If medication access issues are noted, the discharge technician is alerted. Throughout hospitalization, the discharge technician ensures that patient assistance paperwork and prior authorizations are complete, and that prescriptions that have to go to mail order pharmacies are sent before discharge. Additionally, the discharge technician reviews a daily discharge report and retrieves medication reconciliation and discharge summary for use during an 18-21 day follow up phone call. The discharge technician identifies medication problems in need of pharmacist attention.

Results: As of June 11, 52 admission medication reconciliations were complete in the target populations. To establish baseline data, the technician screened 51 admission medication reconciliations completed by personnel external to pharmacy and identified 186 discrepancies (3.62 errors per chart). These errors took on average 7.12 hours to be resolved. Twenty-seven 18-21 day follow up phone calls have been completed and 10 additional calls have been attempted. The discharge technician has also coordinated medications for 8 patients, who otherwise would not have received their medications. Though the goal of the grant was to have the technicians perform medication reconciliation at admission and discharge, the current software systems do not allow technician access to these modules. This barrier to effective medication reconciliation

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is under evaluation by administration. Technicians researched the average cost avoided when medication reconciliation errors are identified and resolved and the pharmacist added this to documentation systems. They also identified standardized nebulizer order forms that were then adapted by the pharmacist, and collaborated with patient assistance program coordinator and bedside delivery team to determine optimal work processes.

Conclusion: Differential roles can be created for pharmacy technicians on new transitions of care pharmacy team, and these roles can directly impact patients throughout the entire admission and after discharge. Furthermore, the technicians can be assigned special projects that support the pharmacist and generate cost-benefit data that supports their positions.

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Professional Poster Abstract

4-083

Category: General Clinical Practice

Title: Clinical pharmacists introduce a new systematic method for performing medication review at Odense University Hospital

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Purpose: The demand for medication reviews (MR) delivered by clinical pharmacists at hospitals is rapidly increasing in Denmark. To ensure that MRs are performed consistently and with similar quality irrespective of the level of experience and knowledge of the individual clinical pharmacist, development of a service model is needed. The model should be versatile to ensure application at all ward types, and the service should be patient centered rather than solely focusing on the medication list. Hence, the aim was to develop a detailed, systematic model for conducting MR.

Methods: It was decided to perform a literature search using the keywords MR method, MR pharmacist, MR model but no relevant articles were found on the subject. Our nearest network including professors in clinical pharmacology and clinical pharmacy and Pharm.D Ph.Ds also haven't been able to find studies that describe a thorough method. Due to lack of relevant literature, it was then decided that there was a need to develop and describe a new model. Our national network was consulted in order to exchange ideas and experience for achieving a systematic versatile method for conducting MR. A preliminary method was piloted on 100 patients by five clinical pharmacists from the clinical pharmacy unit of our community hospital and subsequently adjusted according to the experiences made.

Results: The systematic model for conducting MR includes: First, making sure that medication reconciliation has been performed prior to MR. Second, the patients journal is read to know cause of hospitalization, the patients diagnoses and the medication list. Third, each drug on the current medication list is now coupled to a diagnosis, in order to create an overview of which drugs are treating which diagnosis. Fourth, for each diagnosis the following is considered: Are there untreated diagnoses, Has the goal of treatment been reached, Is the treatment compliant with current national guidelines regarding dose, choice of drug and time of treatment. Fifth, all drugs on the medication list are controlled according to the following: Indication for treatment, Drug dose, considering i.e. kidney insufficiency, age, etc., Adverse drug events, Therapeutic duplication, Dosage time and interval, Drug formulation and strength, Interactions, contraindications, precautions, Specific patient characteristics. Sixth, a patient interview Adherence, adverse drug reactions are i.e. in question during the interview. All in all, use of guidelines and recommendations serve to ensure that the MR is of the highest quality possible, moreover patient interviews make certain that the MR is of highest relevance possible.

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Conclusion: A systematic method for conducting MR was developed and described. This method is now in use by different pharmacists at different wards at our community hospital. Our experience is that the method enables pharmacists at our community hospital and pharmacists at other hospitals independent of level of experience to perform a MR with high quality and high relevance.

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Professional Poster Abstract

4-084

Category: General Clinical Practice

Title: Utilizing pharmacy students during their experiential rotations for patient counseling to improve patient satisfaction

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Purpose: Patient satisfaction is linked to reimbursement from Center for Medicaid and Medicare services (CMS). Hospital Consumer Assessment of Health Providers and System survey (HCAHPS) is the measuring tool used to assess patient satisfaction and is comprised of several questions regarding patient health literacy and medication awareness. St Josephs Wayne Hospital pharmacy has had a significant role in increasing patient health literacy through anticoagulation education. An initiative utilizing pharmacy students to provide a more thorough patient education was proposed and termed the Campaign. This would benefit patient care/satisfaction and expose pharmacy students to direct patient care; the trend in pharmacy practice.

Methods: St Josephs Wayne Hospital is a geriatric focused community institution. The pilot began June 2013 until December 2013 on one nursing unit. Patients discharged to home, not a facility, were the target population. Students were coached extensively to incorporate specific questions included on the HCAHPS survey. Students, under the direct supervision of a pharmacist, obtained pertinent patient information from nursing/case-management and performed initial screens for medication awareness by visiting the patient rooms. Pharmacy students then compiled a list of new medications along with medications used prior to admission that needed to be reviewed with the patient. From that list, the pharmacy student would print medication guides for the medications, highlight pertinent information, and educate to the patient accordingly. Follow-up was performed as if required after the initial encounters. Business cards with pharmacy information were left at the bedside encouraging the patient or caregiver to call the pharmacy if they had any more questions. Pharmacy encounters addressed the concerns raised on the HCAHPS survey but students also addressed any other concerns the patient would raise. Students examined patient home medication lists, performed reconciliations, and brought incongruences or interventions the pharmacists attention.

Results: Patient satisfaction improved on the pilot unit significantly, with over a 29% increase in patient awareness of new medications and over 8% for patient awareness of side effects of medications. Nursing satisfaction and relationships also significantly improved as the pilot expanded through nursing request.

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Conclusion: The Campaign was a valuable experience for pharmacy students. It allowed them to incorporate themselves into the care team, have direct interactions with patients and other healthcare members, learn customer service skills, and learn drug information. The results showed significant increase in patient satisfaction scores related to two specific questions on the HCAHPS survey over a 6 month period. This has allowed for an additional pilot pharmacist to perform discharge counseling and heart failure counseling with the objective of decreasing readmission rate and medication errors.

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Professional Poster Abstract

4-085

Category: General Clinical Practice

Title: Retrospective evaluation of the causes, treatments and outcomes of hypoglycemia in a community teaching hospital

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Purpose: Over the past several years, there has been an increased focus on glycemic control in hospitalized patients. Guidelines from the American Diabetes Association and the American Association of Clinical Endocrinologists recommend blood glucose targets of 140-180 mg/dL in the intensive care unit (ICU) and pre-prandial glucose of less than 140 mg/dL and random glucose levels of less than 180 mg/dL for non-ICU patients. Hypoglycemia is associated with increased mortality and increased length of hospital stay. The purpose of this study was to evaluate the causes, treatments and outcomes of hypoglycemic events.

Methods: The institutional review board approved this retrospective chart review of patients with diabetes who were receiving insulin therapy and had a blood glucose value less than or equal to 70 mg/dL between June 2013 through July 2013. Only the initial low blood glucose was evaluated for each unique patient. Exclusion criteria were as follows: patients admitted with hypoglycemia, laboratory error, inadequate data available, insulin used for other reasons besides glycemic control, pregnancy and neonates. Data was collected on patient demographics, past medical history pertinent to hypoglycemia risk, at the time of hypoglycemic event: clinical signs and symptoms, enteral status, insulin dosing; time to treatment and post treatment data collected included blood glucose outcome and symptom resolution. Finally, the influence of the endocrinology consult service was evaluated.

Results: A total of 128 patients were included in the analysis. The average age was 69 years and 54 percent of patients were female. Eighty five percent of patients had type 2 diabetes and 56 percent were Caucasian. Thirty one percent of patients had a creatinine clearance less than 30 mL/min and 6 percent of patients had liver dysfunction. Interestingly, only 19 percent of patients were symptomatic of their hypoglycemic episode. An evaluation of the causes of hypoglycemia revealed that the insulin dose was the likely cause in 61 percent of patients and NPO/decreased oral intake was the likely cause in 39 percent of patients. Thirteen percent of patients were rechecked in less than or equal to 15 minutes and 69 percent of patients were rechecked in less than or equal to 60 minutes. All symptomatic patients had resolution of symptoms and 77 percent of patients had blood glucose values greater than or equal to 70 mg/dL after treatment. If the insulin dose was deemed the cause of the event, 45 percent of patients had the dose adjusted. For patients being followed by the endocrinology service, this percentage of adjusted insulin doses increased to 96 percent.

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Conclusion: The treatment of hypoglycemia represents an opportunity for improvement. Process improvements such as notification of the prescriber for a change in intake or in anticipation of NPO status as well as adjustment of the insulin dose after hypoglycemic events is warranted. Also, there is an opportunity to improve the time to recheck blood glucose after treatment, especially considering that 23 percent of patients remained hypoglycemic after treatment. Processes that have been put into place for the nursing staff are a hypoglycemia documentation flow sheet and a best-practice alert that fires for blood glucose results less than 70 mg/dL.

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4-086

Category: General Clinical Practice

Title: Stress ulcer prophylaxis: implementation of a pharmacy protocol to discontinue inappropriate proton pump inhibitors

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Purpose: The objectives of this evaluation were to (1) quantify the number of proton pump inhibitors (PPIs) prescribed without appropriate indications; (2) determine whether a pharmacy protocol to discontinue inappropriate PPI therapy would be feasible; and (3) identify trends which may contribute to overuse of PPI therapy.

Methods: A protocol was created defining when pharmacists could discontinue inappropriate PPIs and the protocol was piloted in patients transferred from an intensive care unit to two step-down units (Medical/Surgical Progressive Care Unit and Neurosciences Unit). Random sampling was done by running a report one day each week for ten weeks identifying patients located on either of the floors specified above who were currently receiving a PPI. Data was collected until a total of 100 patient charts had been reviewed. PPI use was considered appropriate if the patient was taking a PPI prior to admission, had an FDA-approved indication for a PPI, or met the ASHP criteria for stress ulcer prophylaxis with a PPI.

Results: Of the one-hundred patients reviewed, 31 were thought to be inappropriately receiving a PPI. Among the 69 patients in which PPI therapy was considered appropriate, GERD was the most common indication (n=34), followed by gastrointestinal bleeds (n=6). Nineteen patients (27.5%) with PPI treatment deemed appropriate had GERD listed on their past medical history and/or a PPI on their prior to admission list. An order set was used to order a PPI in 49 of the 100 patients.

Conclusion: A pharmacy-to-discontinue protocol for PPIs may identify at least one-third of patients who lack an indication for PPI therapy. Reducing the incidence of inappropriate therapy may correlate with reductions in adverse effects associated with the use of PPIs, and thus, reductions in cost. However, chart review is a time-consuming approach and exploration of alternative methods to improve feasibility for protocol implementation is warranted.

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4-087

Category: General Clinical Practice

Title: Recycled inhaler microorganism eradication study

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Purpose: A community hospital was challenged to reduce hospital expenditures of metered-dose inhalers (MDIs) by 50% without compromising patient outcomes or safety. Several institutions utilize a common canister program, which involves: utilizing a common MDI for multiple patients via a patient-specific, one-way valved holding chamber, followed by cleaning before the MDI is administered to the next patient. Another option is the recycled MDI program, where an MDI is dispensed per patient, returned at discharge, cleaned, and recycled to a new patient. This study evaluates three disinfectant methods and their ability to eradicate microbial contamination on aerosol MDIs.

Methods: Samples consisted of used MDIs that had been returned to pharmacy after patients were discharged. A pre-study sample of MDIs (N=30) were swabbed and sent to the microbiology lab to identify surface microorganisms. A multidrug-resistant *Acinetobacter* species, was identified on the used MDIs in the pre-study sample. For the study sample, a microbiologist inoculated the sample of used MDIs (N=45) using a saline suspension of *Acinetobacter* species. Every inhaler was swabbed on the mouthpiece, canister, and boot. Swabs were sent to microbiology lab, set up on blood agar and thioglycollate broth, and incubated for 48 hours. The MDIs were then divided into three disinfectant protocol groups (N=15): 1) 70% isopropyl alcohol (IPA) using a spray method and allowed to dry for 5 minutes, 2) 70% IPA using a spray method, followed by wiping with alcohol pads and allowed to dry for 5 minutes, 3) Sodium hypochlorite towels in a 1:10 dilution using the wipe method and allowed to dry for 5 minutes. After the disinfectant process, the MDIs from all study groups were once again swabbed on the mouthpiece, canister and boot. Swabs were sent to the microbiology lab for culture and 48 hour incubation.

Results: Pre-Study Sample (N=30) resulted in 12 out of 30 MDIs with no bacterial growth; 16 out of 30 MDIs demonstrated growth of only skin flora (*Coagulase-negative Staph*, *Bacillus* species, and *Micrococcus* species). Pathogenic bacteria (*Staphylococcus aureus* and *Acinetobacter* species) were identified on 2 out of 30 MDIs. Because there was growth of a multidrug-resistant *Acinetobacter* species, we chose to inoculate all MDIs used in the disinfection portion of the study with this bacterium. Study Group 1: IPA spray method(N=15)

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resulted in 10 out of 15 MDIs with demonstrated bacterial growth after cleaning. Of 10 isolates, 8 grew *Acinetobacter* species, 1 grew *Streptococcus viridans* which was probably the result of contamination from the investigators, and the last grew unknown gram negative rod which could have been an environmental contaminate. Study Group 2: IPA spray and wipe method (N=15) resulted in 14 out of 15 with no bacterial growth. The one isolate with positive results grew non-pathogenic organisms; *Streptococcus viridans* and *Bacillus* species, which was probably due to skin flora contamination from the investigators. Study Group 3: Sodium hypochlorite towels in a 1:10 dilution (N=15) wipe method resulted in complete eradication of all organisms.

Conclusion: MDIs were inoculated with *Acinetobacter* species. IPA spray alone and IPA spray with wiping were the least effective disinfectant methods. There was no risk for infection or cross contamination in the MDI group disinfected with sodium hypochlorite towels. This disinfectant method would be most appropriate in a recycled MDI program, where the MDIs are cleaned in a controlled environment using standardized technique with drying time before being dispensed to a new patient. The sodium hypochlorite towels are recommended by the CDC for effective disinfecting, and are EPA-registered to kill multidrug resistant organisms in one minute and *C. difficile* spores in five minutes.

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4-088

Category: General Clinical Practice

Title: Evaluation of the appropriateness of the use of albumin in a Lebanese non-teaching hospital

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Purpose: Albumin, the main protein of human blood plasma, has a main function of regulating the colloidal osmotic pressure of blood. This product is being widely used in different hospital units for a variety of indications. Its limited availability and high cost make it essential to define recommendations for its appropriate use as compared to other alternatives since many prescriptions are not supported by literature or guidelines. The aim of this study is to characterize the appropriate practice of prescribing albumin in a Lebanese non-teaching hospital.

Methods: An observational study was conducted in a Lebanese non teaching hospital over a 12-month period from 2012 till 2013. All medical orders presenting to the pharmacy department were screened, and those including an albumin order were selected to assess the appropriateness of albumin use. An evaluation sheet was developed to analyze whether those orders were prescribed for the right indication. This sheet included the floor unit, patients diagnosis, and length of hospital stay, number of vials dispensed, albumin level, and the total cost of the dosage regimen. The average cost of each 20% albumin vial was around 60 US dollars during the study period. A comparison of the indication to the evidence based guidelines was performed and data was analyzed using SPSS software version 19.0.

Results: A total of 111 cases that were receiving albumin were evaluated. The length of hospital stay ranged between 1 and 18 days. Albumin was administered to the patients in the hospital who were admitted to different floors, whereby 49% were in the intensive care setting and 51% in other units. The reference that was followed for the assessment of this practice was entitled Guidelines for Use of Albumin; it was developed by the University Hospital Consortium and was published in the Archives of Internal Medicine (revised version of 2010). In this institution, the major indications for albumin administration were hypoalbuminemia (19.82%), major surgery (18.01%), acute respiratory distress syndrome (17.11%), ascites (6.3%) nephrotic syndrome (6.3%) and septic shock (5.40%). The remaining 27.06% had autoimmune diseases, pancreatitis, head traumas, burns, rectorrhagia, hemorrhage, pulmonary edema, cirrhosis, and plasmapheresis. Further analysis revealed that only 22.52% of all the patients received albumin for its appropriate approved evidence based indication. These findings were distributed as follows: all ascites not responding to diuretics (2C), burns after 24 hours of admission with albumin level > 2g/dl (2C+), and therapeutic plasmapheresis (2C+) patients received albumin appropriately. Moreover, 52.63% of ARDS with Albumin <2g/dl, 25.00% of major surgery with albumin <2g/dl (2C+),

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14.28% of nephrotic syndrome with albumin <2g/dl (2C) abided by the guideline. Moreover, 23.42% of the patients received albumin without albumin baseline levels. The total number of vials administered within the study period was 243 with a total cost 14,580 US dollars, knowing that the cost for the appropriate use was 4020 US dollars.

Conclusion: Based on the above findings and as evaluated against model guidelines, albumin use was found to be inappropriate in most of the cases and imposes a significant financial burden. Education is required to motivate clinicians to use evidence-based guidelines and ensure that albumin is prescribed for maximum benefit and minimal associated risks. The pharmacist should be involved in the implementation of guidelines to ensure this increasingly cost-conscious health care environment the best patient outcome.

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4-089

Category: General Clinical Practice

Title: Pharmacist involvement in mobile medical clinics on medical missions improve formulary management and cost

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Purpose: Short-term medical mission teams are generally made up of physicians and nurses. However, most often, the main task is procuring and deciding which medications and supplies to take on the trip. We evaluated the benefit of having a pharmacist on the team, who lived and worked in Cambodia for three years, on formulary management and cost of dispensed medications in Cambodia from 2012 to 2013 from mobile medical clinics.

Methods: Medications dispensed for all patients were collected on intake forms during week-long mobile medical clinics in Cambodia during Septembers 2012 and 2013. Other information such as height, weight, blood glucoses and blood pressures were also collected from patients over 18 years. This information along with the diagnoses were entered into an Excel spreadsheet without patient identifying information and analyzed for aggregate means, most common diseases, most dispensed medications and cost of medications.

Results: A total of 725 patients were seen. Females made up 60.1% and the mean age was 44.1 years. The total potential cost of purchasing all 68 different medications dispensed in 2013 would have been \$2,637.69. However, due to the procurement of donations from medical outreach organizations, like Americares and Blessings, International, as well as the knowledge of which drugs are available to be purchased in Cambodia, the actual cost of purchasing the medications was \$612.74, a savings of \$2,024.95. In 2012, the total actual purchase cost of 30 medications was \$1,021.29. The biggest cost was incurred from *Helicobacter pylori* treatment packages, which cost \$5 per pack as 22 packs were dispensed. After analyzing this data, the pharmacist recommended using *H. pylori* lab tests and in 2013, only three packs were dispensed. The most common disease was gastritis diagnosed in 175 (24.3%) patients. Hypertension (BP>140/90) was discovered in 152 (21.6%) patients. Pain related to arthritis was the third most prevalent disease in 92 (15.1%) patients. Hyperglycemia (RPG >140 mg/dl) was found in 69 (9.6%) patients. The top five medications dispensed was acetaminophen, omeprazole, ibuprofen, multivitamin, and metformin. Hydrochlorothiazide, atenolol, lisinopril and amlodipine were the most dispensed antihypertensive agents.

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Conclusion: Having a pharmacist on short-term medical mission teams can improve the cost of procurement of medications used on mobile medical clinics and have a well managed formulary. Knowledge of available, local medications can also improve continuity of care of chronic diseases like hypertension and diabetes.

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4-090

Category: General Clinical Practice

Title: Impact of a high fidelity simulation on pharmacists and pharmacy students comfort level when responding to an acute arrhythmia scenario in hospital

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Purpose: Limited research is available on the utility of simulation based learning for competency training of pharmacists and pharmacy students. Therefore, this pilot study assessed the impact of a high fidelity simulation experience on the pharmacists and pharmacy students comfort level in responding to an acute arrhythmia scenario in a hospital. Additionally, the secondary objectives included evaluating the participants ability to recognize an arrhythmia on an ECG and provide appropriate pharmacologic intervention.

Methods: Sixteen pharmacists and fifteen pharmacy students attended a high-fidelity multidisciplinary simulation that mimicked an acute arrhythmia scenario. Surveys were administered to participants prior to attendance at the simulation and after completion of the simulation to assess the impact of the experience on his or her comfort level in an acute arrhythmia scenario. The survey utilized the 5-point Likert scale (1-strongly disagree, 2-disagree, 3-neither agree nor disagree, 4-agree, 5-strongly agree) to assess the participants comfort level. A pharmacist measured the secondary objective by direct observation during the simulation for the correct identification of the rhythm and providing an appropriate pharmacologic intervention.

Results: Attendance at the high-fidelity simulation increased pharmacists and pharmacy students comfort in both identifying an acute arrhythmia on an ECG and recommending an appropriate pharmacologic agent for treatment. Prior to attending the simulation lab only 20% of both pharmacists and pharmacy students agreed or strongly agreed with the statement that he or she was confident in recommending appropriate pharmacologic therapy. After attending the simulation, 87.25% of pharmacists and 93.33% of pharmacy students agreed that he or she was more comfortable in recommending appropriate pharmacologic therapy. Additionally, 75% percent of pharmacists and 80% of pharmacy students agreed or strongly agreed with the statement that he or she would be more comfortable attending a rapid response for a patient with an acute arrhythmia after attending the simulation.

Conclusion: Simulation experience is an effective method for enhancing pharmacist and pharmacy student comfort in participating in acute arrhythmia situations. Pharmacists and pharmacy students may benefit from continued simulation scenarios to help further improve comfort in responding to acute patient scenarios.

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Professional Poster Abstract

4-091

Category: Geriatrics

Title: Medicare beneficiaries attitudes on improving medication adherence

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Purpose: Poor medication adherence increases the risk of morbidity, hospitalization and mortality with clear implications for worsening health outcomes as well as avoidable health care costs. Currently, there are 53.5 million Medicare beneficiaries, 44.6 million (83%) of whom are age 65 or older. On average, seniors take 5-6 prescription medications each month and thus this group could provide valuable input on ways to address issues relating to nonadherence in this population. The purpose of this study was to examine beneficiary input regarding strategies to improve medication adherence in the Medicare population.

Methods: Fourteen health fairs targeting Medicare beneficiaries were conducted throughout Northern/Central California during the 2014 Medicare Part D open enrollment period. At each event, student pharmacists provided medication therapy management (MTM) services under the supervision of licensed pharmacists during which beneficiaries demographic, social and health information was collected. Survey questions regarding strategies to improve medication adherence in domains that included safety, cost, patient education and medication reminders were posed. Survey responses were examined as a function of demographic, socioeconomic and health-related factors. Descriptive and inferential statistics were performed on collected data. The project was approved by the University Institutional Review Board.

Results: Of 720 beneficiaries who were provided MTM services, 679 (94.3%) completed survey questions. Of responders, the following were selected as ways to improve adherence: reminders for when to take medication(s) by 344 (50.7%), reducing drug costs by 337 (49.6%), increased communication about the medication(s) with the prescriber by 296 (43.6%), more time discussing the medication(s) with the pharmacist by 282 (41.5%), reduced pill burden by 277 (40.8%), safer medications by 244 (35.9%), and getting refills easier by 237 (34.9%). Non-subsidy receiving beneficiaries (i.e., those not eligible for Medicaid) were more likely to report reducing drug costs as a means to enhance adherence ($p < 0.01$). Beneficiaries who selected reducing pill burden were taking significantly more prescription medications ($p < 0.05$). Beneficiaries with a greater number of chronic disease states were more likely to report that increased time/communication with the pharmacist ($p < 0.01$) or physician ($p < 0.01$) would improve medication adherence.

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Conclusion: Examining beneficiary input regarding strategies to improve medication adherence is an important step in helping address this significant issue. Medication reminders, the reduction/elimination of cost barriers, particularly for non-subsidy receiving beneficiaries, and facilitating increased time and communication with health care providers were identified as the most effective strategies among study beneficiaries. Decreasing medication nonadherence patterns in seniors and other Medicare beneficiaries should result in improved clinical outcomes, decreased health care utilization and costs and an improved quality-of-life.

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4-092

Category: Geriatrics

Title: Potential clinical interventions to help reduce risk of fractures when assisting older adults seeking Medicare D plans

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Purpose: As adults age, requirements for levothyroxine may decrease and prescribed doses might require adjustment. Overtreatment can reduce bone mineral density and lead to osteoporosis. An association between high dose levothyroxine and an increased risk of fractures has been noted. Use of proton pump inhibitors (PPIs) are also problematic in older adults, similarly being linked with an increased risk of fractures. Additionally, high dose PPIs have been associated with increased mortality, 1-year post discharge from acute care hospitals. The purpose of this study determined the prevalence and doses of these medications in community-dwelling older adults seeking a Medicare D plan.

Methods: The medication lists of Medicare recipients (n=525) seeking plan reviews for Medicare enrollment, 2014, were reviewed retrospectively for use and doses of levothyroxine and PPIs. Medicare recipients were community based and personally requested a plan review for best coverage options. Levothyroxine doses were categorized into low dose (<0.044 mg/d), medium dose (0.044-0.093 mg/d), and high dose (>0.093 mg/d). PPI doses were categorized into low dose (omeprazole 10-20mg/d, pantoprazole 10-20mg/d, lansoprazole 15mg/d, rabeprazole 10mg/d, esomeprazole 20mg/d) and high dose (omeprazole 40mg/d, pantoprazole 40mg/d, lansoprazole 30mg/d, rabeprazole 20mg/d, esomeprazole 40mg/d). Sex and age were recorded.

Results: Medicare recipients (n=525) were primarily in the age range of greater than or equal to 70 years old (n=414, 78.9%) and 15.8% of them were greater than or equal to 85 years old. Most recipients were female (69.5%). Levothyroxine use (n=109, 20.85%) was noted with high dose levothyroxine in 10.3% of adults prescribed. Most of the recipients utilizing the high dose levothyroxine were greater than or equal to 70 years old (9.9%). PPI use was noted (n=209, 39.85%) with high dose PPI in 21.7% of adults prescribed. Greater than half of all recipients taking a PPI were utilizing high doses (54.5%). In the age group greater than or equal to 85 years old, 32.5% were taking a high dose PPI. In addition, just under half of all patients utilizing high dose levothyroxine, were also taking PPIs (48.1%).

Conclusion: PPI and high dose PPIs utilization is prevalent amongst the older adult and patient counseling at the point of providing Medicare D plan reviews could potentially be associated with a decrease in fractures and other serious consequences. Similarly, red flagging those older adults on high dose levothyroxine for pharmacist intervention, may also help reduce

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overtreatment and potential fractures. Future development of patient educational tools along with direct pharmacist counseling when providing Medicare reviews may be beneficial.

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4-093

Category: Geriatrics

Title: Drug treatments improvement through pharmacists interventions in nursing homes

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Purpose: To establish a Pharmaceutical Care (PC) program in nursing homes. To improve drug treatments in elderly people, through pharmaceutical interventions and recommendations, working in a multidisciplinary team. To identify medication related problems. To prevent worsening in patients condition, caused by medication.

Methods: Pharmacy department provides training and support to different care teams in nursing homes. They review clinical reports and medication plans of patients, using an algorithm developed by the pharmacy service of our institution according to criteria of efficacy, safety, efficiency and standards in geriatrics. We asses: current clinical status, goals of care and the potential risk/benefit of each medication. The problems detected and pharmaceutical interventions are communicated to the physicians in conciliation meetings. Interventions were grouped in conciliation, contraindication, dosage errors, duplicity, frequency error, drug omission, not indicated drug, inappropriate geriatric drug, low intrinsic value drug, length of treatment error.

Results: A prospective study was undertaken during August and September 2013. Medication plans of 62 patients (mean age 84 years) were reviewed. 211 interventions were done with a 78% of acceptance by physicians. These interventions were related to: - Conciliation 24% - Drug omission 19% - Drug not indicated 15% - Drug inappropriate in geriatrics 15% - Dosage error 7% - Duplicity 6% - Contraindication 5% - Low intrinsic value drugs 2% - Excessive length of treatment 1% In the 22% of the interventions not accepted, the main reasons were: specialists follow up, the change had been already made before unsuccessfully, prioritize the stability of the patient over the recommendation.

Conclusion: There is a high incidence of medication problems in nursing homes. The work of pharmacists has a high value in the improvement of drug use in these settings. Moreover, it encourages communication and collaboration between professionals. Periodic evaluation of elder patient's drug regimen is an essential component of Pharmaceutical care.

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4-094

Category: Geriatrics

Title: Fall risk related to medication at admission in a psychogeriatric in a psychogeriatric ward related to medication at admission

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Purpose: Patients admitted at Psychogeriatric Unit of a long term care have some characteristics that increase the risk of fall: cognitive impairment, balance disorders and poor mobility, among others, related to the pathology. However, inappropriate prescribing and polypharmacy are considered one of the strongest risk factors for falls in elderly. Thus, the purpose was to evaluate the risk of fall in geriatric patients related to drugs prescribed at admission, in order to establish if improvements in drug treatment would be needed.

Methods: A retrospective, observational study was performed in the Psychogeriatric Unit of a long term care center from January 2012 to January 2014. All the data available in the electronic medical records were reviewed. Study variables collected were: demographic data (age, gender) and the drugs used at admission (recorded generic name; dosage; frequency; route of administration). Patients included had some cognitive impairment, poor mobility, no-cognitive symptomatology and no previous psychiatric pathology.

Results: The final sample included 95 patients. Average age 82.7 years (51% woman-49% man). Mean Mini-mental state examination (MMSE) 15 (moderate cognitive impairment). Mean Barthel Index 35 (severe-moderate dependence). At admission, 76% of patients were polimedicated, with an average number of drugs per patient was 8.4 (range 2-20 drugs). Distribution of patients regarding the fall risk of medication prescribed (Smith M. On behalf of WAM Falls in Elderly Steering Group 2004) were: 83 patients (87%) had high risk drugs, 63 patients (66%) had moderate risk drugs and 37 patients (39%) low risk drugs. Only two patients had medication plans that included drugs without any risk of fall and one patient had every drug of the treatment in different level of fall risk. In the group of high risk: 25 patients had also a high dose of these drugs (2 benzodiazepines, 4 antidepressants, 17 antipsychotics and 2 other). More than 1 high risk drug were found at the same time in 58 (61%) patients prescription plan.

Conclusion: Falls seemed to be a high risk for patients and a high cost challenge for health system. The balance between efficiency treatments and patient safety is especially difficult in elderly patients with dementia and non-cognitive symptomatology. Risk reduction strategies should include involvement of pharmacist in admission and appropriate follow-up. Medication

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review is an essential component of comprehensive falls assessment. A guideline has been developed for medications assessment, that includes recommendations to discontinue medications, decrease the dosage and use other treatments with reduced falls risk.

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4-095

Category: I.V. Therapy / Infusion Devices

Title: Alerts and alarms associated with smart pumps: achieving a healing environment by avoiding annoyances

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Purpose: Patients and their families are annoyed by equipment that makes noise. If the noise is not attended to by staff, annoyance may escalate to fear that something dangerous may occur. IV pumps are inherently located near the bedside, so efforts to minimize un-necessary alarms will directly impact patients and families. Further, work toward optimizing the frequency and response to alarms and alerts from smart pumps addresses the goal of improving the safety of clinical alarm systems (TJC 2014 NPSG 6) The frequencies, character and reactions to different types of alarms from IV pumps have not been quantified.

Methods: We reviewed the definitions of alerts and alarms in order to recommend possible actions to minimize noise from each source. We reviewed the settings in each of the profiles in the smart pump libraries for programming decisions that contribute to frequent alarms or alerts. We collaborated with the pump manufacturers clinical specialist to identify some settings that might contribute to nuisance alerts. We queried the smart pump alarm database for February 2014 to establish baseline data related to alarms and alerts from smart pumps in five representative hospitals (large, medium, small) in our multihospital system.

Results: A single month's alarm data for a large hospital revealed 28937 alarms. Nearly 42% (12104) were patient side occlusion alarms. The second most frequent alarm (6288) was for bolus air-in-line. We use the near-end-of-infusion alarm for PCA infusions, so our devices alarmed 1859 times in five representative hospitals. We choose to implement an audible alert when a secondary infusion completes and returns to a primary infusion. Six short beeps sound whenever that situation occurs, resulting in 277,296 sounds at patients' bedsides. Most of these alerts do not require any action on the part of the nurse.

Conclusion: Some IV pump related alarms or alerts are amenable to CQI interventions, others are not. Decreasing patient side occlusion alarms would require additional attention to opening all tubing clamps prior to beginning an infusion. Many patient side occlusion alarms reflect some clinical aspect of the IV or the patient's position relative to the infusion device. Air in line alarms may be avoided by carefully following manufacturer instructions relative to seating the tubing in the air in line detector. We are considering the safety and patient satisfaction implications of turning off the secondary>primary alert and the PCA near end of infusion alert.

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4-096

Category: I.V. Therapy / Infusion Devices

Title: Appropriate pharmacy handling of protein biopharmaceuticals

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Purpose: Protein biopharmaceuticals make up a substantial proportion of intravenously administered drugs. The proper handling of these drugs in the pharmacy setting is extremely important, and protein-based drugs have a set of stability liabilities that distinguish them from conventional, small molecule drugs. Here, case studies of protein degradation that can occur in IV bags are discussed, along with suggested general guidance for safe handling of protein biopharmaceuticals from a manufacturers perspective.

Methods: Aggregates from one clinical-phase humanized monoclonal antibody were chromatographically isolated and tested for their activity by a cell-based bioassay. A second clinical-phase protein biopharmaceutical, in this case an antibody-drug conjugate, was subjected to physical agitation stress in IV bags and assessed using size-exclusion chromatography to measure the generation of aggregates.

Results: The molecules discussed exemplify some of the consequences of mishandling of protein biopharmaceuticals. In the first example, it is seen that aggregates can dramatically affect the measured bioactivity of the monoclonal antibody, which emphasizes the potential impact of protein degradation products. In the case of the antibody-drug conjugate, the generation of aggregates is directly linked to the physical handling of IV bags. Both of these examples highlight potential risks specific to protein-based drugs, but strategies exist for avoiding these problems, including removing air headspace from the IV bag and the refrigerated transportation of bags.

Conclusion: Ensuring the quality of protein biopharmaceuticals in IV bags may require additional pharmacist attention to how doses are handled compared to conventional drugs, especially with regard to transportation, material compatibility, and beyond-use-dating. An opportunity exists for pharmacists and drug manufacturers to better coordinate the information regarding product handling, such as within the pharmacy literature and in product prescribing information.

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4-097

Category: I.V. Therapy / Infusion Devices

Title: Utilizing a national smart pump drug library database as a benchmark for setting upper and lower limits to reduce alert fatigue and increase patient safety

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Purpose: Smart pumps provide alerts to clinicians prior to bedside medication administration. When programmed medications dosages are outside of predetermined drug library limits, clinicians are forced to override or edit the alert. Smart pump software medication limit entry can be challenging due to finely balancing literature recommendations with prescribing practices. Commonly, literature does not provide specific recommendations for limit placement which can result in nuisance alerts leading to alert desensitization and causing clinicians to ignore valid safety alerts. This benchmarking project focused on the analysis of data from smart pump drug library limit entries as one step toward reducing nuisance alerts.

Methods: In December of 2011, data was extracted from a broad data base of general infusion drug libraries downloaded on infusion devices utilized for patient care areas and service lines within each respective hospital. Information collected included descriptors of hospital type, size, generic medication name displayed on the infuser, medication concentration, dose rate units, lower hard and soft, upper soft and hard limits. Information was loaded into a database program (Microsoft Access 2007) and queries were written to extract drug library entries. The collection of data was used to identify what percentages of limits were associated with each of the medications that were built using the smart infusion safety software. This information was analyzed to characterize the frequency of lower hard and soft, upper soft and hard limits, dose rate units that were utilized and the frequency of occurrences. For specific medications with like service lines, dosing units and indications, descriptive statistics were generated for the lower hard limit, lower soft limit, upper soft limit and upper hard limit parameters. The descriptive statistics included mean, standard deviation; median, first quartile, third quartile, mode, minimum and maximum for lower hard, lower soft, upper soft and upper hard limit values.

Results: The data extract resulted in 188,236 drug library entries. These individual entries were associated with 459 unique generic medication names. Thirty-six different services lines were associated with the drug library entries with Medicine-Adult, ICU-General and Emergency Services accounting for 15%, 14% and 11% of entries. Although 19 different dose rate units were used in the libraries, only 4 dosing units accounted for 83.4% of drug library entries with mL/hr, mcg/kg/min, mg/hr and mg/min accounting for 61.6%, 8.1%, 7.1%, and 6.6% respectively. Drug library upper limit entries parameters in place were considerably higher than

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lower limit entries by a ratio 5:2 margin. Descriptive statistics on lower hard, lower soft, upper soft and upper hard limit parameters were generated for 251 medication entries accounting for 92% (173,117/188,236) of the total drug library entries.

Conclusion: Analysis of medication safety limits gathered from hospitals across the United States has provided the first step in a collaborative approach to increasing patient safety. The development of this multi-hospital benchmarking tool can provide a framework to create drug library limits by providing hospitals a statistical starting point to place limits. This tool will also allow for continuous evaluation of smart pump alert information compared to national benchmarks. With this data and combined multifaceted approach, the opportunity to potentially reduce nuisance alerts, improve drug library utilization at the bedside and further enhance patient safety within healthcare facilities is limitless.

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4-098

Category: I.V. Therapy / Infusion Devices

Title: Evaluation of the compliance of a standardized dosing schedule of extended infusion piperacillin/tazobactam in a community hospital

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Purpose: The purpose of this study was to evaluate compliance with a standardized administration schedule and infusion programming of extended infusion (EI) piperacillin/tazobactam dosing protocol. In February 2012, Banner Estrella Medical Center (BEMC) implemented an EI piperacillin/tazobactam dosing protocol in order to maintain blood concentrations for longer periods, which allows for less frequent dosing, and cost savings. Recently, a standardized dosing schedule was implemented to assist with scheduling of multiple infusions and compatibility concerns.

Methods: Per the implemented protocol, all infusions are scheduled to be given over 4 hours. Doses were scheduled to be given either every 8 hours at 0600, 1400, and 2200 or every 12 hours at 0600 and 1800 for patients with renal impairment. For 10 days, from May 27, 2014 to June 5, 2014, the number of EI piperacillin/tazobactam infusions that were rescheduled by the nursing staff outside of the standard administration time were recorded by reviewing the electronic medication administration records (eMAR). Rescheduling was defined as an infusion started at least an hour before or after the scheduled time. To assess for EI compliance, the Alaris pumps were visually inspected 2 hours after the doses were initiated. The number of doses administered in less than 4 hours were recorded. Data was also divided between the day shift and night shift to look for possible trends. Day shift included the 1400 and 1800 doses and night shift included the 0600 and 2200 doses.

Results: During the specified time period, 91 EI piperacillin/tazobactam doses were evaluated. A total of 34 EI piperacillin/tazobactam doses were analyzed during the day shifts. Four out of 34 doses (11.8%) were rescheduled and all 34 doses (100%) were given as 4 hour infusions. A total of 57 piperacillin/tazobactam doses were analyzed during the night shifts. Five out of 57 doses (8.8%) were rescheduled and 2 doses (3.5%) were not given as 4 hour infusions. In total, a 90% (82 out of 91 doses) compliance with dose scheduling and a 98% (89 out of 91 doses) compliance with infusion programming was observed.

Conclusion: Our results suggest that staff is successfully administering the EI piperacillin/tazobactam doses as 4 hour infusions. In contrary, the rates of nurses rescheduling the doses remain high. Additional education is warranted regarding prioritization of multiple

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infusions when using the EI piperacillin/tazobactam dosing protocol. With improved adherence to the protocol, further studies can be done to assess the impact on clinical outcomes and overall cost savings.

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4-099

Category: I.V. Therapy / Infusion Devices

Title: Practical evaluation of four large volume smart pump infusion devices to guide replacement pump selection process in a specialty hospital

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Purpose: Due to the planned market removal of the current large volume smart pump infusion device, Hospira Symbiq, four replacement pumps were evaluated at a specialty hospital. Hospital leaders considered critical pump drug library features during the replacement pump selection process.

Methods: Over a one-month period four large volume smart pump infusion devices were demonstrated to hospital staff. A pharmacist evaluated each device for suitability as a replacement device in regards to current smart pump drug library requirements. Critical features include wireless functionality, alarm volume programming, drug lookup, dosing features, library capacity, lowest flow rate, and the ability to bypass safety software. Pumps evaluated were B. Braun Outlook 400ES, Baxter SIGMA Spectrum, CareFusion Alaris, and Hospira Plum A+. Pharmacy findings of key pump functionality and drug library features were presented to hospital leaders.

Results: All pumps considered had wireless drug library updating functionality. Current compliance with Hospira Symbiq library use for the facility is 99.7%. Users are automatically directed to safety software with Baxter SIGMA Spectrum but users must choose to utilize safety software with all other pumps evaluated. Periodic audits will be required to determine if compliance with drug library is maintained when replacement pump is implemented. Drug programs are designed to be specific for Clinical Care Areas (CCAs). CareFusion Alaris and Baxter SIGMA Spectrum capacity exceeds thirty CCAs while the capacity for B. Braun Outlook 400ES and Hospira Plum A+ is less than twenty. Forty CCAs were available with Hospira Symbiq. Combination of areas may be required during the development of a replacement drug library. The number of drug entries in all pumps was considered to be adequate for current hospital needs. Very low flow rates are encountered in neonatal populations. The lowest flow rate possible for Baxter SIGMA Spectrum was 0.5 mL/hr. All other pumps considered could deliver flow rates of 0.1 mL/hr. Pump alarm volume use in neonatal populations was identified as potential area of educational focus.

Conclusion: A variety of safety features are currently available on large volume smart pump infusion devices. Pharmacy evaluation of key features helps to determine pump suitability for hospital patient populations and identify key areas for education and compliance auditing during and after implementation.

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4-100

Category: Infectious Diseases

Title: Reducing clostridium difficile rates: a team-approach

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Purpose: Deborahs dedicated antibiotic stewardship team goes above and beyond to make sure reducing infection rates is our top priority. This year we have chosen to develop a C.difficile Task Force at Deborah dedicated to reducing our C.difficile infection rates by 50%. With infection rates increasing at such a rapid rate, a team effort was needed to holistically address the issue.

Methods: A clinical pharmacist created the C.difficile Task Force which consisted of the following: two infection prevention nurses, a board certified infectious disease physician, a microbiologist, an environmental services representative, a dietician, and a transport representative. As a group, we identified the problems as well as determined a method to reduce transmission rates. New protocols went into place about contact precautions, care and management of a C.difficile patient, and cleaning/transporting a C.difficile patient. A C.difficile patient management form went into effect on the floors as a trial, and eventually to the whole hospital, providing nurses with a step by step checklist on how to manage a C.difficile patient.

Results: With a combined multidisciplinary team effort and help from all the departments of the hospital, our hospital acquired C.difficile infection rates reduced by 50% within 8 months. We analyzed the standardization of clinical care by developing a nurse driven C.difficile protocol that allowed nurses to send out stool samples without a physicians order and follow steps on how to manage a C.difficile patient to reduce transmission rates. The environmental and transportation teams worked together to invest in bleach containing products to thoroughly clean rooms and transport equipment. With team members educating our staff, even physicians were more cognizant of the antibiotics that were being ordered and discontinued proton pump inhibitors (medications that are known to increase C.difficile rates) that were not indicated.

Conclusion: In recent years, C. difficile infections have become more frequent, more severe and more difficult to treat. Our infection rates at Deborah were steadily increasing, with more hospital acquired infections that were being reported to the CDC. However, creating a team of representatives from the different departments of the hospital allowed us to tackle the task at hand and put into effect new and revised protocols that not only reduced hospital acquired infection rates, but educated the rest of the staff on the importance of cleanliness, contact precautions and certain side effects of common medications.

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4-101

Category: Infectious Diseases

Title: Effects of antibiotic hang on time on sepsis patient's outcome; first observational study in Qatar

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Purpose: -determine the time between writing antibiotics and starting infusion in sepsis patients in selected care units across hamad general hospital. -determine the effect of hang on time on patient's outcome (time to get negative culture,length of hospital stay ,length of stay on mechanical ventilation ,length of intensive care unit stay ,and patient mortality) .

Methods: -it's a prospective observational study which conducted in 4 main care units (medical intensive care unit ,surgical intensive care unit ,male general medical unit ,and male general surgical unit). -inclusion criteria according to survival sepsis campaign guidelines for patients with suspected sepsis,severe sepsis ,and septic shock .

Results: -total of 50 patients included in the study (sepsis,severe sepsis,septic shock patients),most of them were admitted to intensive care units. -community sepsis patients were associated with better outcome and lower mortality rate . -older patients were associated with higher mortality rate .

Conclusion: in conclusion the early administration of antibiotic in sepsis, severe sepsis and septic shock patients is associated with better patient outcome,lower length of hospital stay ,and lower mortality rate.

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4-102

Category: Infectious Diseases

Title: Complicated Mycobacterium avium complex pulmonary disease in a HIV negative patient: a case report

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Case Report

Purpose: Mycobacterium avium complex (MAC) is a well documented opportunistic infection in patients with human immunodeficiency virus (HIV) infection. In comparison, information regarding MAC and other non tuberculosis mycobacteria (NTM) disease remains limited in HIV negative patients. Hence, we describe a complicated case of pulmonary MAC disease in a HIV negative patient without preexisting lung disease. A 65 year old African American male presented with a 2 week history of productive cough and shortness of breath. Past medical history was insignificant. His social history included alcohol abuse and a 50 pack year smoking history; however, he reported decreased consumption of alcohol and cigarettes over the last year. Right upper lobe consolidation and cavitary lesions were detected upon chest x ray and computed tomography scan. The patient received empiric antibiotics for pneumonia and was admitted for further rule out of tuberculosis. Over the next 3 days, the patient's respiratory function rapidly deteriorated. He was intubated and admitted to the intensive care unit with septic shock secondary to respiratory failure. Although his initial tuberculin skin test and sputum acid fast bacilli (AFB) smears were negative, subsequent bronchial smears were positive for rare AFB. Empiric antituberculosis agents were added and adjusted to azithromycin, ethambutol, and rifampin upon identification of MAC. His clinical status became further complicated by metabolic toxic encephalopathy, intracranial hemorrhage, multi organ failure (e.g. hepatic failure, renal failure) and adverse drug reactions. While on rifampin, the patient developed acute interstitial nephritis and subsequent acute renal failure. Rifabutin, initiated in place of rifampin, was associated with significant eosinophilia. This was attributed to suprathreshold doses after the patient experienced significant weight loss secondary to disease progression. After a prolonged inpatient stay, the patient was ultimately discharged to a long term acute care facility. The incidence of pulmonary NTM is increasing in the United States. However, cases may be underreported due to variable presentation and disease manifestation. NTM, such as MAC, should be considered in patients with otherwise unexplained pulmonary disease.

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4-103

Category: Infectious Diseases

Title: Clinical outcomes & cost savings from using a compounded inhaled tobramycin solution

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Purpose: During the 2013 national inhaled tobramycin solution (Tobi) shortage, Palomar Health switched to compounding their own inhaled tobramycin solution for the treatment of cystic fibrosis exacerbations and bronchiectasis. We sought to determine if switching patients to a compounded inhaled tobramycin solution would result an increased incidence of adverse effects or treatment failures.

Methods: This study was a retrospective chart review of electronic medical records from a community-based health system in Southern California. Outcome data for patients during the inhaled tobramycin shortage was compared to patients treated prior to the drug shortage. Chart reviews and cost analysis were performed as part of the study.

Results: Between May 2013 and April 2014, Palomar Health treated 13 patients with 19 courses of compounded inhaled tobramycin solution. There were no adverse events. Ten of the courses were continuation of home therapy for patients with cystic fibrosis or bronchiectasis. Neither the patients nor the respiratory therapists noticed a difference in clinical response. Nine of the patients were treated for pneumonia with inhaled tobramycin to avoid systemic aminoglycoside therapy. Most of them were elderly or had poor renal function. Two patients had their inhaled tobramycin therapy discontinued when sputum culture results identified an organism resistant to tobramycin. One patient expired from septic shock and multi-organ failure. Palomar Health spent \$2,342 compounding inhaled tobramycin solution, which resulted in a \$14,000 yearly savings. When inhaled tobramycin solution became available again, its cost had increased by 30% to that prior to the shortage. Had Palomar Health switched back to using inhaled tobramycin solution in November 2013, the projected expenditure would have been \$7,926. The compounded solution was so well tolerated that the pulmonologists chose to continue using the compounded inhalation solution.

Conclusion: Compounded inhaled tobramycin solution was found to be as effective and well tolerated as the commercially available inhaled tobramycin solution for the management of cystic fibrosis exacerbations, bronchiectasis, and pneumonia. There was significant cost savings associated with compounding the inhalation solution compared to using the commercially available product.

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4-104

Category: Infectious Diseases

Title: Evaluation of vancomycin pharmacokinetic dosing: transition from total body weight to adjusted body weight

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Purpose: Current vancomycin dosing guidelines published in 2009 recommend the use of total body weight (TBW) for all patients, while acknowledging that limited data is available for dosing in obese patients. Recent clinical data indicates dosing based on TBW in overweight and obese patients can lead to frequent elevated troughs and subsequently a higher incidence of nephrotoxicity. This study was designed to assess how vancomycin troughs compare to body weight and identify if modifying the pharmacy dosing strategy from TBW to adjusted body weight (ABW) would decrease suprathreshold trough levels and therefore reduce the potential for nephrotoxicity.

Methods: A retrospective review of all vancomycin trough data from September 2012 through January 2013 was conducted within our 336 bed institution. This analysis revealed an excessive number of troughs exceeding acceptable therapeutic range and a disproportionate percentage of these troughs occurred in obese patients. Vancomycin dosing during this period was based on total body weight and not standardized throughout the pharmacy department. In February 2013 a standardized pharmacokinetic dosing calculator was implemented using adjusted body weight in all patients. Patients receiving hemodialysis or vancomycin pulse dosing due to renal dysfunction were excluded from all analyses. The attainment of target vancomycin trough values and nephrotoxicity were compared retrospectively between an original protocol based on TBW, which had been associated with high troughs, and a revised protocol based on ABW.

Results: The evaluation of 5 months of TBW vancomycin dosing identified a correlation between body mass index (BMI) and elevated troughs (BMI > 29 = 35.8%, BMI 20-29 = 26.5%, BMI < 20 = 23.0%, respectively). In an effort to reduce the percent of elevated troughs the pharmacy department changed to ABW dosing. This change was made for all patients since ABW lowers doses for overweight and obese patients with little effect on other patients. After changing to the revised protocol we evaluated the subsequent 12 months of data and compared it to the prior 5 months of TBW dosing to assess if the change reduced elevated troughs without a large increase in subtherapeutic troughs. The percent of troughs greater than 22 mcg/ml decreased from 28.0% to 9.4%, while the percent of troughs less than 10 mcg/ml increased from 9.0% to 13.8%. The 22 mcg/ml threshold was used because small variations above the therapeutic range were considered clinically insignificant and unlikely to contribute to negative

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patient outcomes. Cases of vancomycin associated nephrotoxicity were also evaluated and compared to baseline data. The percent of pharmacy vancomycin dosing consults with reported nephrotoxicity decreased from 1.0% using TBW dosing to 0.47% using ABW dosing.

Conclusion: Use of the adjusted body weight dosing protocol greatly reduced the percentage of elevated troughs, while only slightly increasing the percentage of low troughs. Overall the percentage of trough values between 10-22 mcg/ml increased from 66.0% to 76.9% with the change in dosing strategy. Also, as expected the reported incidence of vancomycin associated nephrotoxicity decreased with the revised ABW protocol.

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4-105

Category: Infectious Diseases

Title: Correlation of carbapenem usage to extended spectrum beta-lactamase producing and carbapenem resistant Enterobacteriaceae rates at a midsize community hospital

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Purpose: Global rise and spread of extended spectrum beta lactamase producing (ESBL) Enterobacteriaceae and carbapenem resistant Enterobacteriaceae (CRE) over the last several years is becoming an increasing healthcare concern for the United States. In October 2013, McLaughlin et al., published the study, Correlations of Antibiotic Use and Carbapenem Resistance in Enterobacteriaceae, in which they found a positive correlation for the use carbapenems to the incidence of carbapenem-intermediate or -resistant Enterobacteriaceae at Northwestern Memorial Hospital, an 897-bed tertiary hospital located in a midwestern state. The question that our review will be examining is whether information published from a large tertiary hospital will offer any external validity to our mid-size, 326-bed community hospital that is also located in a midwestern state. This review will attempt to examine the possible correlation of local usage of carbapenems compared to Enterobacteriaceae resistance rates.

Methods: The Department of Pharmacy at this facility maintains an ongoing antibiotic database with usage reported using the World Health Organization Define Daily Dose (DDD). A retrospective analysis of the information pertaining to carbapenem usage was extracted for this review. The DDD will be reported as per 1000 patient days with the monthly patient days utilized as reported by this facility's Infection Prevention Committee. A retrospective review of the Department of Pharmacy clinical documentation was performed to identify patients having either an extended spectrum beta-lactamase producing Enterobacteriaceae or carbapenem resistant Enterobacteriaceae. This documentation is part of the antimicrobial stewardship initiatives at this hospital which involves the prospective review of all microbiological culture and sensitivity reports that have positive results on a daily basis. A collection period from January 2012 to March 2014 was chosen for the review to include a large enough sample size and a time frame long enough to capture resistance trends. Results were evaluated with the Microsoft Excel software data analysis package using Pearson correlation and descriptive statistics. This report has been reviewed by our Institutions IRB Committee and granted IRB exemption under CFR 46.101 - #4.

Results: The mean monthly carbapenem usage from January 2012 to April 2014 was 31.5 +/- 8.0 Defined Daily Doses / 1000 patient days with a median usage of 31.7 Defined Daily Doses / 1000 patient days. Carbapenem usage was consistent for the study period with the average use of carbapenem for the first three months of the review at 30.4 Defined Daily Doses / 1000 patient days and the last three months usage being 30.1 Defined Daily Doses / 1000 patient days. No strong correlation was found from the use of carbapenems to our prevalence of ESBL producing Enterobacteriaceae or CREs. Pearson correlation coefficient for combined carbapenem use versus Enterobacteriaceae positive extended spectrum beta lactamase producing organisms was r

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= -0.25. Combined carbapenem use versus CRE showed a Pearson correlation coefficient of $r = 0.09$. Correlation analysis for ESBL Enterobacteriaceae prevalence to individual agents is as follows: imipenem / cilastatin ($r = -0.11$), doripenem ($r = 0.44$), meropenem ($r = -0.27$) and ertapenem ($r = -0.14$). Correlation analysis for CRE prevalence to individual agents is as follows: imipenem / cilastatin ($r = -0.32$), doripenem ($r = -0.20$), meropenem ($r = 0.13$) and ertapenem ($r = 0.34$).

Conclusion: No correlation was seen from our hospital carbapenem use to the prevalence of ESBL Enterobacteriaceae or CRE for the given observational time period. The lack of correlation may limit some of the external validity that can be applied from a large tertiary hospital to this mid-size community hospital. In general, the problem of increasing carbapenem use and possible increase of CRE is of major concern for healthcare. For our hospital, we have seen over a two and a half fold increase in carbapenem use from 2008 through 2014. This is a concerning trend and we will need to continue to be vigilant with our support of antimicrobial stewardship activities including, but not limited to, prospective antimicrobial daily review and infection prevention. Limitations on this review could be the use of the more readily available DDD in place of the days of therapy used in the 2013 McLaughlin paper, limitations on laboratory reporting and smaller prevalence of both extended spectrum beta lactamase producing Enterobacteriaceae and carbapenem resistant Enterobacteriaceae at this hospital.

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4-106

Category: Infectious Diseases

Title: Multidrug resistance prevalence and antimicrobial stewardship preparedness 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). The initial step to address MDROs in a large multi-hospital health system is to evaluate current state of antimicrobial stewardship across the system.

Methods: A survey from 85 hospitals of a single healthcare system evaluated the prevalence of MDROs, and the presence of antimicrobial stewardship programs (ASPs). Questions addressed the prevalence of MDROs and local measures to optimize antimicrobial use. We compared the results based on hospital bed size (small ≤ 200 , medium 201-500, large > 500 beds).

Results: Larger hospitals had the highest reported rates of *Klebsiella pneumoniae* carbapenem resistant organisms. Hospitals (n=81, 95.3%) reported producing an antibiogram, with 77 (90.6%) at least annually. ASPs were more established in large (n=6, 100%) and medium (n=22, 81.5%) compared to small (n=12, 23.1%) size hospitals (p<0.001). ASPs varied from having restricted antimicrobials with specific uses, post-prescribing evaluation by pharmacists, to pre-approval or consultation by Infectious Diseases physicians, and clinical pathways. Infectious Diseases pharmacist approval was rarely used.

Conclusion: The prevalence of MDROs and the presence of ASPs varied based on hospital size. Smaller hospitals may be less prepared than larger ones to address antimicrobial stewardship. Our findings contribute to a better understanding of the varied needs of our hospitals to develop future processes and optimize patient care outcomes.

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Category: Infectious Diseases

Title: Development and implementation of evidence based influenza virus vaccine utilization for 2014-2015 season in the largest not-for-profit health system in the United States

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Purpose: Seasonal influenza impact 10% - 20% population each year. Virus circulation, illness and associated deaths are more predominant with A than B virus. On average, all vaccine efficacy is around sixty percent. A Quadrivalent vaccine was introduced in the market recently. The new vaccine contains the traditional trivalent ingredients and two B strains. An expert group was formed to evaluate clinical evidence and develop usage criteria for influenza vaccine ordering for 2014-2015 season.

Methods: The expert group was comprised of infectious disease physicians and pharmacists and they evaluated pertinent literature, market basket and cost differences. The group concluded that the new product demonstrated non-inferiority to trivalent vaccine in adult patients. The group reviewed the need for the new vaccine in pediatric population because of the additional B strains to protect them from severity of illness. They recommended trivalent vaccine use for adult patients, health care workers and left quadrivalent vaccine use decision in pediatric population to individual hospitals based on clinical judgment. The recommendation was then approved by system clinical group, therapeutic affinity group and clinical excellence committee. The expert group also formulated situation/background/assessment/recommendation (SBAR), frequently asked questions (FAQs), background Power Point slides and pertinent literature for sharing with the clinicians and they were placed on our web site. Presentations on the topic to the clinicians were also provided by the expert group. Because of the urgent need for placing orders for 2014-15 season, clinical directive went out to our individual hospital chief executive officers, chief medical officers and director of pharmacies for immediate implementation in February 2014. Order utilization by individual hospitals was tracked on a weekly basis and clinical assistance provided, if needed.

Results: Our comprehensive intervention resulted in trivalent vaccine ordering in 80% of the cases and a cost savings of \$1.3 million. We also faced barriers such as lack of buyer knowledge, automatic manufacturer conversion to quadrivalent vaccine. However, our weekly tracking and immediate intervention with hospitals and manufacturers resulted in the conversion to appropriate ordering as recommended by the expert group.

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Conclusion: Clinician driven integrated approach and partnership with all stakeholders resulted in the implementation of evidence based ordering of influenza vaccine for 2014-15 season.

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4-108

Category: Infectious Diseases

Title: Evaluation of intraoperative antibiotic redosing in general surgery patients

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Purpose: Surgical site infections are associated with increased hospital cost, length of hospital stay and mortality. Perioperative antimicrobials have been proven to be efficacious in reducing incidence of surgical site infections. Therapeutic Guidelines on Antimicrobial Prophylaxis in Surgery published in February 2013, provided new recommendations on intraoperative repeat-dosing, weight-based dosing, and duration of prophylactic antimicrobials. The purpose of this study was to assess compliance to the updated protocol and determine its effect on rate of post-operative surgical site infections.

Methods: The institutional review board approved this pre-post, retrospective, randomized group study. Surgical procedures conducted in patients 18 years and older by the Division of General Surgery were evaluated at two time periods: procedures completed between November and December 2012 and November and December 2013. Cases performed in November and December 2012, prior to change in guidelines served as comparators for those performed in November and December 2013. Patients who were pregnant, had antibiotic use within 24 hours of procedure or did not receive any intraoperative antibiotics were excluded. 100 patient charts were reviewed, 50 in each cohort year. The primary outcome measure was compliance to intraoperative redosing protocol. Secondary outcome measured was change in rate of post-operative surgical site infections. Compliance was assessed using documented information provided on anesthesia record. Post-operative infection rates were evaluated using an International statistical classification of disease (ICD-9) code for post-operative surgical site infections.

Results: A total of 834 pat general surgery and had procedures performed over the two time periods. All cases met inclusion criteria. 50 patient cases conducted in 2013 were evaluated for compliance to protocol and surgical site infections. 94% of cases evaluated were in compliant with redosing protocol; 74% of cases did not require any redosing based on procedural length or antibiotics selected; 26% required redosing, of these 23% were not redosed. Rate of surgical site infection was observed in 4% of cases performed in 2012 vs. 2% of cases in 2013.

Conclusion: Majority of general surgery cases evaluated were in compliant with protocol, however cases that utilized cefoxitin or zosyn were less compliant than those that utilized

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cefazolin. Although there was a high compliance rate, further education regarding redosing of agents with shorter half-lives should be provided to surgical and anesthesia team.

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4-109

Category: Infectious Diseases

Title: Prevalence and risk factors of healthcare associated Clostridium difficile infections at a long-term acute care hospital (LTACH)

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Purpose: Clostridium difficile infection (CDI) is one of the most common healthcare-associated infections (HAIs) causing considerable morbidity and mortality. According to the Centers for Disease Control and Prevention (CDC) CDI rates remain at high levels in short term acute care setting. However there is limited epidemiological data regarding healthcare-associated Clostridium difficile infection (HA CDI) rates in long term acute care hospitals (LTACHs). This study is designed to evaluate the prevalence of and risk factors associated with HA CDI at an 83 bed LTACH.

Methods: During the period from January 1 to December 31, 2013, the Hospital Infection Preventionist used patient symptoms and results of Loop Mediated Isothermal Amplification Technology (LAMP) to identify patients as having HA CDI. A retrospective review was completed on the charts of all patients with positive HA CDI results. HA CDI risk factors that were analyzed include advanced age defined as 65 years and older, exposure to antimicrobial agents, underlying immunosuppression, gastrointestinal surgeries, acid-suppressing medications, chronic renal impairment requiring dialysis, and respiratory treatment including tracheostomy, ventilator, BiPAP or CPAP, or oxygen therapy.

Results: During the one-year study period, eleven cases of HA CDI were identified with an overall incidence rate of 0.6 cases per 1000 patient days. Of the 11 patients with HA CDI, 6 (55%) were of advanced age, as defined previously. All patients (100%) with HA CDI had antimicrobial exposure prior to diagnosis and, among those individuals, 6 out of 11 received 3 or 4 antimicrobials while 3 were administered 2 antimicrobials; the remaining 2 patients were exposed to only levofloxacin. Proton pump inhibitors were part of the medication regimens of 9 of the 11 patients (82%) and 9 (82%) received respiratory treatments prior to HA CDI diagnoses. Gastrointestinal surgeries had been performed on 5 (45%) of the patient group and underlying immunosuppression was identified in 36% (4) of the patients. Chronic renal impairment requiring hemodialysis was a factor for a single patient (9%) included in this study. The majority (73%) of the patients in our study group had 3 or more risk factors including antimicrobial exposure, acid suppressants use and respiratory treatments before HA CDI diagnosis.

Conclusion: This LTACHs HA CDI incidence rate is lower than average rate of acute care hospital report on the National Healthcare Safety Network (0.6 cases per 1000 patient days)

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versus 0.7 cases per 1000 patient days). This lower HA CDI rate is interesting as patients at LTACHs usually have more comorbid diseases, are older and have extended exposure to antimicrobials and an extended hospital stay. This lower HA CDI rate may be related to our antimicrobial stewardship program, enhanced isolation precautions, in-depth environmental services education and a hand-hygiene program. Future study may include automatic isolation upon admission to prevent HA CDIs.

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4-110

Category: Infectious Diseases

Title: Antibiotic stewardship within the intensive care unit

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Purpose: Antimicrobial agents are commonly prescribed medications within the intensive care unit. Antibiotic stewardship programs optimize clinical outcomes and minimize adverse consequences associated with suboptimal utilization of agents. This study was designed to measure the effects of an antibiotic stewardship initiative in the intensive care unit.

Methods: This was a prospective study of fifty patients who received at least one dose of antibiotic therapy in a twelve bed intensive care unit at a community teaching hospital between February to April 2014. The pharmacotherapy resident made prospective antibiotic therapy recommendations based upon indication, likely pathogens, culture sensitivities and available formulary agents directly to the medical team. The primary outcome was time to de-escalation of antibiotic therapy and secondary outcomes included days of effective therapy and cost savings. Therapy was deemed effective if the empiric agent was appropriate for the site of infection and pathogen-driven therapy matched culture and sensitivity reports.

Results: Twenty four patients were enrolled in the study resulting in an average of 3.5 days until de-escalation. The total average antibiotic duration was approximately 13 days of which 92.7 percent were considered effective antibiotic therapy. Twenty five interventions were made involving a de-escalation of the antibiotic regimen. Sixteen of these interventions were antibiotic de-escalations while nine interventions were antibiotic discontinuations.

Conclusion: This study indicates the benefits of a pharmacist driven antibiotic stewardship program by optimizing antimicrobial utilization and total antibiotic exposure within the intensive care unit.

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4-111

Category: Infectious Diseases

Title: Impact of an antimicrobial stewardship at an 82 bed long-term acute care hospital (LTACH): second-year follow-up report

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Purpose: To optimize the appropriate use of antimicrobials and to prevent the emergence of antimicrobial resistance, an Antimicrobial Stewardship Program (ASP) was implemented at an 82-bed Long Term Acute Care Hospital (LTACH) in June 2012. The initial purpose of the study was to document the impact of an ASP including antimicrobial utilization and its affect on healthcare costs over a one year period. The ASP was continued for a second year. This is the Year 2 follow up report.

Methods: The antimicrobial stewardship committee consisted of two infectious disease (ID) physicians and one ID pharmacist who continued using a standard antimicrobial order form developed in the Year 1 study and continued antimicrobial use policies which require physicians to de-escalate empiric therapy within 72 hours as implemented in the first year study. The initial 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. At year 2, this facility has one ID physician therefore all intensivists of the facility were allowed to prescribe any antimicrobials with or without ID physician consultation. All the pharmacists of the facility communicated with ID physicians and intensivists for appropriate dosing, interval and de-escalation recommendations when needed. The facility's infection preventionist was also actively involved in ASP monitoring of Hospital Acquired Infection rates, communicating with physicians regarding multi-drug resistant organism (MDRO) reports and educating hospital staff on hand-hygiene. Patient days, medication cost, average length of stay, and the case mix index data were compared before and after implementing ASP. The data was continuously collected until May 31, 2014 to compare with baseline and the first year of ASP implementation.

Results: The patient-days (PDs) during the Baseline period from June 2011 to May 2012 were 22,228 with an average length of stay (ALOS) 27.71. During the Year 1 period of June 2012 and April 2013, PDs were 21,304 with ALOS 27.27. During the Year 2 period of June 2013 and May 2014, PDs were 14,633 with ALOS 26.70. Year 2 ALOS as compared with Baseline decreased by 3.78%, Year 2 as compared with Year 1 decreased by 2.13%. The case mix index (CMI) of the Baseline and Year 1 were both 1.28; the CMI for Year 2 was 1.46 with an increase of 13.6% from the Baseline. Overall drug cost per patient-day for Year 2 was \$71.95, a decrease of 8.6%

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from \$78.14 Baseline; an increase of 17% from \$61.46 Year 1. Antibiotic cost per patient-day for Year 2 was \$39.95, a decrease of 0.26% from \$40.60 Baseline; an increase of 30.38% from \$30.64 Year 1. Antifungal cost per patient-day of \$1.66 Year 2 went down from \$2.38 Baseline and \$1.68 Year 1, a decrease of 43.38% and 1.2% respectively. Antiviral cost per patient-day of \$3.66 for Year 2, decreased 11.2% from \$4.07 Baseline and decreased 0.27% from \$3.65 Year 1.

Conclusion: ASP implementation at an 82-bed LTACH showed a reduction in the ALOS under the same CMI between the baseline and intervention period in Year 1; in Year 2, even with a CMI increase of 13.6%, the ALOS decreased further. More MDRO infections and higher severity of patient conditions were related with an increase in medication costs from Year 1 to Year 2; however, costs were still lower than the Baseline prior to ASP implementation. The study showed ASP helped a cost reduction in antimicrobials, antifungals and antivirals for two years after implementation.

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4-112

Category: Infectious Diseases

Title: Compliance with national guidelines for the treatment of persistent methicillin-resistant *Staphylococcus aureus* bacteremia and associated clinical outcomes

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Purpose: Persistent methicillin-resistant *Staphylococcus aureus* (MRSA) bacteremia is associated with significant morbidity and mortality. The 2011 Infectious Diseases Society of America (IDSA) MRSA treatment guideline recommends adjusting antibiotic therapy after approximately seven days of persistent bacteremia, including eliminating the foci of infection (if not already performed), and high dose daptomycin (10 mg/kg) in combination with another antibiotic (gentamicin, linezolid, trimethoprim-sulfamethoxazole, rifampin or any beta-lactam). However, compliance with IDSA antibiotic recommendations for persistent MRSA bacteremia and associated outcomes has not previously been described in the literature.

Methods: This single center, retrospective study included adult patients with persistent MRSA bacteremia admitted to the University of Michigan Health System (UMHS) between September 2011 and April 2014. Persistent bacteremia was defined as isolation of MRSA in blood cultures despite appropriate antibiotic therapy for at least seven days. Demographic, antibiotic treatment, source control and outcomes data were collected through review of the electronic medical record. Adjustments in antibiotic therapy for the treatment of persistent MRSA bacteremia were reviewed and classified as fully compliant (change therapy to high dose daptomycin in combination with another agent), partially compliant (change therapy to daptomycin monotherapy, or low-dose daptomycin (<10 mg/kg) in combination with another agent), or non-compliant (no antibiotic adjustment). Descriptive statistics were utilized to evaluate compliance with treatment recommendations and associated clinical outcomes, including 30-day all-cause mortality, length of hospitalization and re-hospitalization due to MRSA bacteremia.

Results: Over the study period, 92 patients with MRSA bacteremia were identified and 12 (13%) patients had persistent disease. Among patients with persistent disease, four (33%) received non-compliant therapy, eight (67%) received partially compliant therapy, and zero patients received fully compliant therapy. 30-day mortality was 50% (6/12) in patients with persistent bacteremia; 75% (3/4) in patients receiving non-compliant therapy and 37.5% (3/8) in patients receiving partially compliant therapy. The foci of infection were eliminated in 6/12 (50%) patients. The median length of hospitalization was 29.5 days (range: 8-84 days). 30-day readmission for MRSA bacteremia was observed in two (17%) patients; one patient received partially compliant treatment and one patient received non-compliant treatment.

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Conclusion: Persistent MRSA bacteremia is associated with significant rates of mortality, length of hospitalization and hospital readmission. Compliance with IDSA treatment guidelines is suboptimal.

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4-113

Category: Leadership

Title: Development and implementation of an inpatient prescription delivery service

Primary Author: Sean Chantarapanont; Email: schantarapanont@northshore.org

Purpose: It has been reported that 15 to 20 percent of hospital inpatients do not fill discharge prescriptions. As a result, delays in outpatient treatment can lead to deterioration of the patients health, readmission to the hospital, and mortality. Many reports of pharmacist-led interventions have described improvements in patient satisfaction and increased hospital revenue. The objective of this project is to describe the development and implementation of an inpatient prescription capture program that allows patients to have their medications filled before discharge in a community hospital setting

Methods: A multidisciplinary taskforce including nurses, physicians, social workers, discharge planners, hospital admissions personnel, pharmacists, and pharmacy technicians was created to assist with the design and implementation of this program. A clinical pharmacist and pharmacy technician facilitated the filling of discharge prescriptions. A computerized list of anticipated discharges was reviewed by the pharmacist who then coordinated with outpatient pharmacy technicians to fill prescriptions at discharge. If patients indicated that they would like to utilize the service, the clinical pharmacist would then notify the outpatient technician, who was then responsible for coordinating medication fill and delivery. Measures of success include pre- and post-implementation health care assessment of health providers (HCAHPS) scores for communication about medications, as well as financial impact.

Results: Over the eight week pilot, the HCAHPS score for Communication about medications, for the units trialed increased from an average of 68.5 percent to a two month average of 73.1 percent, with a high of 77.8 percent. Over the course of the pilot, 101 prescriptions have been filled and delivered for 53 patients. The net revenue associated with the pilot program was over 1,500 dollars. Based on the success of the pilot program, the service is being rolled out onto other areas of the hospital. Over the eight week pilot, the HCAHPS score for Communication about medications, for the units trialed increased from an average of 68.5 percent to a two month average of 73.1 percent, with a high of 77.8 percent. Over the course of the pilot, 101 prescriptions have been filled and delivered for 53 patients. The net revenue associated with the pilot program was over 1,500 dollars. Based on the success of the pilot program, the service is being rolled out onto other areas of the hospital.

Conclusion: Patient access to outpatient prescriptions have significant implications on compliance with medications, which has been shown to effect clinical, economic and humanistic outcomes for our patients. As shown in this program pilot, implementation of a discharge prescription service improved patient access to hospital based outpatient pharmacies. The program improved HCAHPS scores and increased revenues to justify additional pharmacy resources.

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4-114

Category: Leadership

Title: Knowledge, attitude, risk perception, and awareness of HIV/AIDS in Lebanon among pharmacy students.

Primary Author: Fida Drouby; Email: fidadr@gmail.com

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Purpose: Acquired immunodeficiency syndrome (AIDS) is a chronic, progressive and fatal condition caused by human immunodeficiency virus (HIV). Reports from Lebanese Ministry of Public Health (MOPH) show an increase in new HIV/AIDS cases in Lebanon from 93 cases in 2010 to 109 cases in 2011. As health care professionals, pharmacists are involved in spreading awareness on preventive measures and offering counseling to HIV/AIDS patients to limit infection rates. The objective of the study was to assess the level of knowledge on disease and mode of transmission of HIV/AIDS among pharmacy students at the Lebanese International University (LIU).

Methods: A cross-sectional observational study was conducted from 1st to 23rd of May 2013 at LIU. A simple 4-pages questionnaire was constructed based on extensive review literature and previous related studies and then validated. All pre-pharmacy and pharmacy students enrolled in Beirut and Bekaa campuses were asked to fill the questionnaire only once, during the last 20 to 30 minutes of each pharmacy course session. The primary objective, to detect level of knowledge on disease and mode of transmission, was assessed using yes/no/dont know scale. Yes/no questions were used to evaluate secondary endpoints such as source of information, attitude and risk perception, and level of awareness of HIV/AIDS status in Lebanon. Statistical analysis was performed using SPSS version 21.0. Three scores (disease, transmission, total knowledge [sum of the latter 2]) were calculated, for which dont know and missing answers were considered incorrect. Multiple bivariate analyses were performed for the primary endpoints and scores for differences in gender, marital and academic status, age groups, and others. Chi-squar, Fisher exact, Student T and ANOVA Wilcoxon and KruskalWallis tests were used for statistical analysis when appropriate. Statistical significant is considered at p-value of 0.05.

Results: A total of 458 students 35% pre-pharmacy and 65% pharmacy participated in the study. Results showed a mean of 8.5/12 on disease, 14/18 on transmission, and 22.7/30 on total knowledge score. Mean score difference between pre-pharmacy and pharmacy students was statistically significant ($p < 0.0001$) for all scores. Among most observed misconceptions were HIV testing is not mandatory before marriage in Lebanon (43%), HIV cannot be transmitted through sexual intercourse if female is taking oral contraceptives (40%) or from nursing mother to her breastfeed baby (45%), while it can be transmitted through mosquito bites (51%) and fate/destiny (15%). When looking at students attitudes and risk perception, 24-45% were not willing to share meals, work in same office or shake hands, 28-31% thought infected patients

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should be educated in separate schools and universities, 62-75% did not discuss the disease with their parents or partners and believed that HIV/AIDS is still a taboo in Lebanon. 76-89% of students believed that HIV/AIDS campaigns are not adequately or frequently made in Lebanon and should be more organized to spread awareness, and 91% had never checked the Lebanese MOPH website for HIV/AIDS information nor knew any Lebanese AIDS associations. Only 2% would refer to a pharmacist if tested positive for HIV.

Conclusion: Exhaustive efforts by the World Health Organization (WHO), and many other associations have led to global reduction of 12% in annual incidence of HIV infections from 2009 to 2012. However, the targeted 50% reduction by 2015 becomes nearly impossible without robust preventive measures. This study underlined some misconceptions, negative attitudes, risk perception misunderstanding, and decreased awareness of HIV/AIDS in Lebanon among LIU pharmacy students. Incorporation of more HIV/AIDS lectures and out-reach activities into pharmacy curriculum can aid pharmacy students in gaining enough education to feel competent working safely with and providing treatment, care and counseling for HIV/AIDS patients as future health care professionals.

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Category: Leadership

Title: Performing a medication utilization evaluation (MUE) on a newly marketed medication for postsurgical pain: liposomal bupivacaine in spinal fusion patients in a community hospital

Primary Author: Jaime Glasgow; Email: jamie.glasgow@lovelace.com

Purpose: Exparel, bupivacaine liposome, is a long-acting non-opioid local analgesic for postsurgical pain. Studies suggest administration post-operatively allows extended (72 hours) pain relief, decreased opioid consumption and length of stay. Exparel, added to formulary in April 2012, was minimally used until October 2013 when an increase in utilization by spine surgeons was observed. Suboptimal use has a negative effect on system/patient cost and potentially patient outcome, thus it was necessary to evaluate Exparel for formulary retention. The objective of this study is to evaluate cost and patient benefits of Exparel in spinal fusions in a community hospital with limited data/administrative resources.

Methods: Retrospective chart reviews were conducted to identify patients who underwent a spinal procedure between July 2013 and April 2014. After review, it was determined that the most frequent procedure spine surgeons had begun using Exparel for was DRG code 460 or Spinal fusion except cervical without MCC, which is the only DRG included in the MUE. A data collection form for medical record abstraction was designed to collect all necessary data: age, sex, weight, height, admission/discharge dates, surgery end-time, pain medication, and pain scores. The MUE was designed to measure the impact of Exparel following spinal fusion on average length of stay (ALOS), opioid consumption, post-operative pain, and total cost of pain medications. A cohort of control patients, who received standard post-operative pain control rather than Exparel, were matched for procedure and demographic characteristics. The null hypothesis was no difference between the two treatments. A statistical analysis plan was developed including: summary descriptive statistics (means, percentages) and Fishers exact test (two independent samples t-test). Data collection and statistical analysis plans were communicated to pharmacy administration, quality, and spine surgeons. This MUE is exempt from review by the institutional review board because it is being completed as a quality improvement project.

Results: Over the eight week pilot, the HCAHPS score for Communication about medications, for the units trialed increased from an average of 68.5 percent to a two month average of 73.1 percent, with a high of 77.8 percent. Over the course of the pilot, 101 prescriptions have been filled and delivered for 53 patients. The net revenue associated with the pilot program was over 1,500 dollars. Based on the success of the pilot program, the service is being rolled out onto other areas of the hospital. Over the eight week pilot, the HCAHPS score for Communication about medications, for the units trialed increased from an average of 68.5 percent to a two month average of 73.1 percent, with a high of 77.8 percent. Over the course of the pilot, 101 prescriptions have been filled and delivered for 53 patients. The net revenue associated with the

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Conclusion: Patient access to outpatient prescriptions have significant implications on compliance with medications, which has been shown to effect clinical, economic and humanistic outcomes for our patients. As shown in this program pilot, implementation of a discharge prescription service improved patient access to hospital based outpatient pharmacies. The program improved HCAHPS scores and increased revenues to justify additional pharmacy resources.

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4-117

Category: Oncology

Title: Multicenter study of environmental contamination with antineoplastic drugs in 34 Canadian hospitals

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Purpose: In 2004, the National Institute for Occupational Safety and Health published an alert on the prevention of the occupational exposure to hazardous drugs. This led to an international review of guidelines, policies and procedures for the safe use of hazardous drugs. Since 2014, the guideline for hazardous drugs sterile compounding that was published by the Ordre des Pharmaciens du Quebec, states that environmental monitoring of hazardous drugs should be conducted twice per year. The aim of this study was to describe a multicenter environmental monitoring study of cyclophosphamide, ifosfamide and methotrexate in oncology pharmacy and patient care areas in Quebec.

Methods: This is a descriptive and comparative study. Twelve standardized sites were sampled in each participating center. Six sampling sites were in pharmacy areas: shipment reception counter, storage shelf, front grille inside the hood, floor in front of the hood, service hatch or post-preparation validation counter and drug delivery tray. Six sampling sites were in patient care areas: storage shelf, priming counter, arm rest, patient room counter, outpatient clinic counter, surface of drug container. Samples were analyzed for the presence of cyclophosphamide, ifosfamide and methotrexate by ultra-performance liquid chromatography tandem mass spectrometry technology. The limit of detection (LOD), in picogram per square centimeter, was 0.36 for cyclophosphamide, 0.95 for ifosfamide and 0.97 for methotrexate. A sample was considered positive if the value was above the LOD. Descriptive statistical analyses (median, 75th percentile, maximum) were carried out.

Results: In 2014, 34 hospitals from Quebec, Canada, participated in this study. A total of 408 samples were quantified. Eighteen samples that were not standardized were excluded from the analysis. There were two to eleven out of twelve positive sampling sites per hospital. Overall, 56 percent (216/389) of the samples were positive for cyclophosphamide, 23 percent (91/389) of the samples were positive for ifosfamide and 10 percent (37/389) of the samples were positive for methotrexate. The sampling sites that were the more frequently contaminated in pharmacy areas were the front grille inside the hood (82 percent of cyclophosphamide positive samples, 27/33 samples) and the floor in front of the hood (82 percent of cyclophosphamide positive samples, 27/33 samples). The sampling sites that were the more frequently contaminated in patient care

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areas were the arm rest (91 percent of cyclophosphamide positive samples, 30/34) and outpatient clinic counter (77 percent of cyclophosphamide positive samples, 23/30 samples). The 75th percentile value of cyclophosphamide surface concentration was of 14 picogram per square centimeter. The 75th percentiles for ifosfamide and methotrexate concentrations were lower than the LOD.

Conclusion: Three other multicenter studies were conducted in 2008-2010, 2012 and 2013 in Quebec, with, respectively, 25, 33 and 36 hospitals. In all studies, similar sites were the more frequently contaminated, such as the front grille of the hood, the floor in front of the hood, arm rests and outpatient clinic counters. Even though the analytical technique was improved and lower limits of detections were used, we observed that the proportion of positive samples remained constant since the 2008-2010 study. Nonetheless, the 75th percentile surface concentration of antineoplastic drugs measured have been decreasing to a plateau since 2012.

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4-118

Category: Oncology

Title: Budget impact of genetic testing for the BRAF V600E mutation and subsequent dabrafenib therapy compared to dacarbazine therapy for the treatment of unresectable metastatic melanoma

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Purpose: The purpose of this evaluation is to summarize existing clinical and economic evidence and discuss the implications of the findings to clinical practice. Our overall objective is to perform a budget impact analysis regarding the use of dabrafenib (and corresponding genetic testing) in place of dacarbazine for the treatment of unresectable metastatic melanoma patients in the MassHealth population.

Methods: A clinical and economic search was undertaken to identify the cost and clinical effects of both dabrafenib and dacarbazine to be applied to our budget impact. We identified the population in Massachusetts with melanoma, who are newly diagnosed and therefore treatment naive, and extrapolated the increase in population over a 3 year time period using the known increase in prevalence per year. We excluded patients 65 or older due to assumed Medicare coverage, leaving the adult population covered solely by MassHealth to be analyzed. We further narrowed our population to those with unresectable metastatic melanoma, who are eligible for treatment with either dabrafenib or dacarbazine, using diagnostic rates identified from our clinical evidence search. By applying the cost and efficacy data available, we were able to perform a budget impact analysis on our extrapolated population over a 3-year time period (2014-2016).

Results: Clinical trials have shown that dabrafenib has significantly greater response rates than dacarbazine (the standard of care) in patients with the BRAF-V600E mutation. Dabrafenib therapy provides an additional 2.4 months of progression free survival (total response rate 50%) compared to dacarbazine (total response rate 6%). The proposed population of newly diagnosed patients with unresectable metastatic melanoma with the BRAF-V600E on MassHealth insurance from 2014-2016 was 11.36 patients. The average cost of treatment until progression was \$41,780/patient treated with dabrafenib \$2,156/patient treated with dacarbazine. The budget impact of a formulary replacement of dacarbazine with dabrafenib was -\$449,732/11.36 patients. A sensitivity analysis was preformed using 25%, 50%, and 75% replacement of dacarbazine use with dabrafenib and the budget impact was -\$100,307, \$-224,788, and -\$349,576, respectively. A

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cost sensitivity analysis using the lowest and highest available WAC was also performed resulting in a range of -\$448,428 to -\$450,777). In addition to a large budget impact, the cost attributed to varying therapy response was prominent. Dabrafenib treatment arm had a total response, disease stability, and no benefit cost contribution of 49.7%, 42.3%, and 5.4%, respectively. In contrast, the dacarbazine showed cost contributions of 6.3%, 47.6%, and 36.5%, respectively.

Conclusion: The budget impact of incorporating dabrafenib therapy into clinical practice is significantly more expensive than the current standard of care, however the efficacy superiority requires further consideration.

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4-119

Category: Oncology

Title: Evaluation of adherence to chemotherapy induced emesis prevention guidelines in Lebanese hospitals

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Purpose: The occurrence of chemotherapy induced nausea and vomiting (CINV) is upsetting for patients, and may discourage them from continuing with chemotherapy. In addition, patients may suffer from nutrition depletion, metabolic imbalances, and poor performance status; thus, affecting their quality of life and ability to perform the activities of daily living. The purpose of this study was to evaluate the adherence to NCCN guidelines in the prevention of emesis for high ematogenic chemotherapeutic agents in Lebanese hospitals.

Methods: This prospective multicenter observational study was approved by the institutional review board. Men and women aged 18 years and above were observed if they were receiving intravenous high ematogenic chemotherapy. Patients receiving moderate, low, or minimal ematogenic intravenous chemotherapeutic agents, oral agents, or radiotherapy as part of their treatment were excluded. 300 patients were screened over a period of 6 months, where 106 patients have met the eligibility criteria and were observed. The primary outcome measure was evaluation of CINV prevention adherence to the NCCN guidelines in terms of antiemetic agents selection. Secondary outcomes included evaluation of adherence of CINV preventive approaches in terms of dosing and duration of antiemetic drugs. Data are expressed as frequencies, and evaluation of primary and secondary outcomes utilized analysis of chi-square.

Results: Most patients were not adhered to the preventive antiemetic prophylaxis guidelines in terms of the antiemetic regimen selection (81.13 percent versus 18.87 percent). Although all patients were receiving a prophylactic regimen consisting of a 5-hydroxytryptamine antagonist and a steroid, only 13.2 percent were receiving a neurokinin receptor antagonist. Similarly, 70.75 percent of the non-adhered patients were receiving metoclopramide as part of their prophylactic antiemetic regimen. For the secondary outcomes assessment, all doses of the administered antiemetic agents were consistent with the NCCN recommendations. However, gaps were noted in the duration of the given therapy. Those gaps were noted in 67.92 percent of the assessed patients, where those patients were receiving only the 5-hydroxytryptamine antagonist for 5 days, whereas steroids were given only once before the chemotherapy.

Conclusion: Non-adequate adherence to NCCN guidelines was found in CINV prevention in Lebanese hospitals. Hence, the clinical pharmacist should encourage more use of neurokinin

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receptor antagonists, and stress on the importance of steroids continuation for 4 days to have an optimal CINV prevention, particularly for delayed emesis.

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4-120

Category: Oncology

Title: An evaluative study of student pharmacists' oncology/chemotherapy knowledge from didactic curriculum and experiential experience from six colleges of pharmacy

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Purpose: With the rapid growth of oncology therapies including ambulatory care, the need for pharmacists to understand chemotherapy-related issues is critical. The FDA has approved more oral oncology agents in recent years and patients are being treated as outpatients. These changes are challenging pharmacists to have a better understanding of treatment modalities. The concern is whether the advances in oncology are being adequately addressed in the curriculums of colleges of pharmacy. This study was designed to survey student pharmacists about the level of knowledge they obtained through didactic curriculum as well as IPPEs, APPEs, and internships related to oncology modalities.

Methods: This evaluative study was approved by the Institutional Review Board. A twenty-five question survey was designed by a student pharmacist and a pharmacy faculty member. The survey was pilot tested and sent out to six accredited colleges of pharmacy from four different states. The questionnaire responses were on a 11-point sliding scale with lower numbers including zero showing disagreement and higher numbers representing agreement. The survey was delivered using Qualtrics and the data were analyzed using SPSSx software. Inferential and descriptive statistics were used to analyze the data. The primary outcome variable was to determine at what point in their education they learned about oncology therapies. Secondary outcome variables included comfort level of a patient-professional interactions when discussing oncology/chemotherapy and exposure to oncology topics during experiential experiences. The survey obtained information from students in all four professional years of pharmacy school. Students were queried as to when they would like to have oncology introduced into their curriculum as well as experiential experience.

Results: The survey was completed by 403 students from 6 colleges. The responses were broken down and analyzed by professional year in college. There was approximately a 4-5 point increase from professional year two to professional year three in the students general understanding of chemotherapy. The average score regarding knowledge from IPPEs was 1.7 for community and 4 for institutional. Students in their fourth professional year responded with a 5.9 out of 10 for exposure and knowledge of oncology/chemotherapy gained from their APPEs. Students in their fourth professional year also expressed a score of 5.8 pertaining to their ability to identify side effects of chemotherapy and a score of 5.4 in their ability to counsel a patient on the side effects of their chemotherapy. Students from all professional years gave an average score of 6.4 stating that they think pharmacy colleges should introduce oncology/chemotherapy

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earlier in the curriculum and a 7.2 out of 10 recommending more required information on oncology/chemotherapy/radiation therapies as a part of their APPE experiences.

Conclusion: Student pharmacists are receiving very little exposure to oncology-related topics during their experiential experiences. Most students do not receive didactic oncology knowledge until the third professional year. Students did respond that they were not as comfortable with oncology-related topics especially the ability to identify adverse events and counsel patients. Even following their APPEs in their last year, students responded that they are still not as comfortable with these topics. Colleges may need to consider incorporating oncology-related topics earlier and provide more exposure during the experiential. This would support the need for additional training for pharmacists working with oncology patients. An evaluative study of student pharmacists oncology/chemotherapy knowledge from didactic curriculum and experiential experience from six colleges of pharmacy.

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4-121

Category: Oncology

Title: Healthcare resource utilization and expenditures for febrile neutropenia in patients with lung cancer, breast cancer, or non-Hodgkins lymphoma

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Purpose: Chemotherapy-induced febrile neutropenia (FN) is a potentially life-threatening condition that often requires hospitalization and is therefore associated with substantial costs. The objective of this study was to describe the resource utilization and expenditures, from an insurance payers perspective, associated with hospitalization and outpatient care in patients with breast cancer, lung cancer, or non-Hodgkins lymphoma (NHL) who experienced an FN event.

Methods: Adults aged ≥ 18 years with newly diagnosed breast cancer, lung cancer, or NHL between January 1, 2006 and December 31, 2009 and who initiated myelosuppressive chemotherapy at any Kaiser Permanente Southern California (KPSC) medical center were included. Patients who received bone-marrow/stem-cell or solid-organ transplants, had white blood cell abnormalities ≤ 6 months before initiating chemotherapy, or received chemotherapy ≤ 12 months before diagnosis were excluded. Each chemotherapy cycle within the first course and FN events (defined as hospitalization with ICD-9 codes for neutropenia and/or fever and/or infection) were identified for patients from all KPSC medical centers. Patients were followed through the chemotherapy course. If no subsequent chemotherapy was observed ≤ 60 days after a patients last treatment, the course was assumed completed unless the patient had died. Economic outcomes included number of FN-related hospitalizations, office-based and emergency department visits not leading to hospitalization, inpatient length of stay (LOS) for FN-related hospitalizations, and inpatient and outpatient expenditures (costs associated with office-based visits and emergency department encounters through the end of each cycle for the first chemotherapy course in 2013 USD) associated with these visits. This study was approved by the KPSC Institutional Review Board.

Results: 3217 patients were identified, and 618 (19.2%) experienced ≥ 1 FN event during their chemotherapy course (breast cancer, n=271 [43.9%]; lung cancer, n=225 [36.4%]; NHL, n=122 [19.7%]; mean [SD] age, 61.9 [11.7] years; women, 68.1%; Caucasians, 70.4%; Hispanic, 19.3%). For patients with breast cancer, lung cancer, and NHL who had FN, the mean number of FN-related hospitalizations was 1.2, 1.2, and 1.5, the mean number of office-based visits was 15.6, 16.4, and 21.4, the mean number of emergency department visits was 1.4, 1.5, and 1.5, and the mean LOS was 4.7, 5.6, and 6.5 days. LOS was relatively stable across all chemotherapy

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cycles. For patients with breast cancer, lung cancer, and NHL, the mean (95% CI) expenditure for FN-related hospitalization was \$23,228 (\$20,706–\$25,750), \$27,768 (\$24,631–\$30,905), and \$41,420 (\$34,265–\$48,575), the mean (95% CI) expenditure for office-based visits was \$3341 (\$3044–\$3639), \$3511 (\$3093–\$3928), and \$4583 (\$3923–\$5244), the mean (95% CI) expenditure for emergency department visits was \$1756 (\$1624–\$1887), \$1795 (\$1627–\$1962), and \$2258 (\$1984–\$2532), and the mean (95% CI) total expenditure was \$28,163 (\$25,591–\$30,735), \$32,760 (\$29,611–\$35,909), and \$48,058 (\$40,835–\$55,281).

Conclusion: This study of the KPSC Cancer Registry found substantial economic burden, as well as variation in resource utilization and expenditures among patients with lung cancer, breast cancer, or NHL who had FN. The highest expenditures for patients with FN were associated with inpatient hospitalization.

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4-123

Category: Oncology

Title: Assessment of response to prophylactic antiemetic regimens in Lebanese hospitals

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Purpose: Nausea and vomiting are well recognized adverse events that are associated with the use of chemotherapy in cancer patients. The commonly used regimen, in Lebanese hospitals, to prevent chemotherapy induced nausea and vomiting (CINV) is a combination of a serotonin antagonist, a steroid, and metochlopramide. The purpose of this study was to assess response to the typically used anti-emetic regimen in Lebanese patients receiving moderate to high ematogenic intravenous chemotherapy.

Methods: This prospective observational study was approved by the institutional review board. Men and women aged 18 years and above were observed if they have had any type of cancer, and were receiving moderate to high ematogenic intravenous chemotherapy, and given an antiemetic prophylaxis. Patients receiving low to minimal ematogenic intravenous chemotherapeutic agents, oral chemotherapeutic agents, or radiotherapy as part of their treatment regimen were excluded. 300 patients were screened over a period of 6 months, where 150 patients have met the eligibility criteria and were observed. Patients were assessed about any nausea and/or vomiting that may have occurred anytime during 5-day period post chemotherapy. Patients were also asked about the frequency and severity of episodes, if they have occurred. The primary outcome measure was the overall response to the antiemetic regimen. Secondary outcomes included the occurrence of nausea and vomiting, independently, during the 5 days post each high or moderate ematogenic chemotherapy regimen.

Results: All patients were adequately controlled the day of chemotherapy administration. However, only 30 percent were well controlled within 5 days after chemotherapy, where 70 percent have developed delayed emesis. For patients receiving high ematogenic chemotherapy, vomiting episodes, within the 5-day period post chemotherapy, occurred in 60 percent, and 80 percent suffered from nausea throughout the day, for more than 3 days. For the moderate ematogenic chemotherapy regimens, 30 percent developed emesis in the 5-day period, and 40 percent suffered from nausea throughout the day, for more than 3 days.

Conclusion: The typical commonly used regimen for CINV prevention is not yet optimal in the Lebanese clinical oncology settings. Therefore, the clinical pharmacist has to stress on the use of neurokinin receptor antagonists for decreasing risk of delayed emesis, as well as the introduction of the newly approved olanzapine to improve patient outcomes.

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4-124

Category: Oncology

Title: Problems associated supportive care for chemotherapy-induced nausea and vomiting in Japan

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Purpose: Treatment with cancer chemotherapy without impairing patient's quality of life requires cooperation between various professions. Among them, pharmacists who engage in cancer chemotherapy need to have substantial knowledge on not only cancer treatment but supportive therapy. One of the important supportive therapies is antiemetic therapy. In Japan, Clinical Practice Guidelines in Antiemesis was formulated in 2010. Aiming to offer appropriate antiemetic treatment for each patient, we implemented a pharmacist-managed case survey in current medical practice.

Methods: We enrolled patients who received their first two or more courses of anticancer drug treatment with highly emetogenic chemotherapy (HEC) or moderately emetogenic chemotherapy (MEC). The primary end point was complete response (defined as no vomiting and no need for rescue treatment for 7 days). Secondary end points were complete response in the acute and delayed phases, rates of control of nausea and vomiting, food intake, constipation, and satisfaction with treatment. Patient's self-administered daily report of symptoms (frequency of vomiting, food intake, constipation, and satisfaction with treatment) was used for the study. Pharmacists filled out the form, including patient's baseline characteristics, regimens of antitumor treatment, and information on antiemetic treatment.

Results: We analyzed 32 patients whose daily reports of the two courses were obtained. The complete response rate was higher in the first course group than in the second course group. Between-treatment group comparison revealed that the complete response rate was higher in patients who received MEC with aprepitant than those without aprepitant.

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Conclusion: Our study also suggested that patients with several personal characteristics were more likely to be at high risk for chemotherapy-induced nausea and vomiting; younger age, female gender, a history of low or no consumption of alcohol, and experience of motion sickness, and experience of hyperemesis in pregnancy. Results regarding other secondary end points will be presented.

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Category: Oncology

Title: Clinical management of radiation-induced oral mucositis using diclofenac mouthwash and effects of prostaglandins in a hamster model of mucositis

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Purpose: Radiotherapy treatments for head and neck cancer can cause ulcerative mucositis, leading to impaired nutrition, increased risk of infection and rapid deterioration of a patient's quality of life. Oral mucositis can also result in delayed treatment and a need to reduce the radiation dose. Local anesthetics, anti-ulcer agents and anti-inflammatory agents are used for the treatment of oral mucositis. In this study, we evaluated the clinical use of diclofenac mouthwash for radiation-induced oral mucositis. We also evaluated the effect of prostaglandins on radiation-induced oral mucositis in a hamster model, because prostaglandins are reported to have diverse anti-inflammatory effects.

Methods: A retrospective study was undertaken in 112 head and neck cancer patients treated with radiotherapy. Data were collected from 1 January 2011 to 31 March 2014 at Ehime University Hospital. The patients who used diclofenac mouthwash (composed of 25 mg sodium diclofenac, 1250 mg tranexamic acid and 2.5 g sodium bicarbonate per 500 mL of distilled water) were evaluated for pain relief, food intake, incidence of oral mucositis, grade of oral mucositis, and xerostomia. In the experimental study, oral mucositis was induced in hamster cheek pouch by applying a single 30 Gy dose of X-irradiation. Prostaglandin E2 (PGE2) or F2alpha (PGF2alpha) were administered at a dose of 200 micro g/cheek pouch once a day after irradiation. Effects on the oral mucositis score, myeloperoxidase (MPO) activity (as a marker of inflammation) and histopathological aspects were evaluated. The present study was carried out in accordance with the guidelines for the care of human and animal study participants adopted by the Ethics Committee of Ehime University Hospital.

Results: Eighty-five percent of patients treated with diclofenac mouthwash reported relief from the pain associated with oral mucositis during radiotherapy. In contrast, grade of oral mucositis, incidence of oral mucositis and xerostomia were not significantly affected by diclofenac mouthwash. In the radiation-induced oral mucositis model, PGF2alpha treatment improved the oral mucositis score, which was decreased, and led to improved recovery from severe ulceration, relative to the group treated with radiation alone. In contrast, PGE2 showed no beneficial healing effects in irradiated oral mucosa. The histopathology of the cheek pouches of hamsters subjected to radiation-induced oral mucositis revealed intense cellular infiltration with a high prevalence of

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neutrophils and extensive ulcers when compared with the cheek pouches of hamsters not subjected to oral mucositis. Treatment with PGF₂alpha reduced the radiation-induced infiltration of inflammatory cells, ulceration, and formation of abscesses. Furthermore, PGF₂alpha treatment significantly reduced MPO activity, and areas of re-epithelization were observed.

Conclusion: Clinical use of diclofenac mouthwash had a beneficial effect on pain relief in patients with oral mucositis induced by radiotherapy. However, grade or incidence of oral mucositis was not reduced. Diclofenac mouthwash may therefore be considered as a palliative treatment which improves the quality of life through pain relief. In contrast, results of the animal study suggest that treatment with PGF₂alpha has a healing effect on the oral mucositis induced by irradiation through anti-inflammatory activity and promotion of tissue repair. PGF₂alpha may therefore be an effective treatment for oral mucositis.

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Category: Pain Management

Title: Novel approach to treating inpatient pain and reducing therapeutic duplication, range orders and meperidine utilization

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Purpose: Our facility is a small rural hospital, which is part of a two hospital county system that owns the majority of healthcare in the county. For years we struggled with therapeutic duplication of pain medication and range orders. Being in a small facility, the physicians, though often very helpful, had never been receptive to changes in these areas. The high rate of therapeutic duplication resulted in a recommendation from The Joint Commission. With the weight of The Joint Commission on our side and the medical staff seeing this as a priority, we moved to correct these issues.

Methods: A pain order set was developed which we think was the first of its kind. The order set cascades on 2 axes, IV/IM versus oral therapy and patient allergy. The physician selects a level of pain treatment A-E and the orders do the rest, with exception. Each level of treatment includes injectable treatment (morphine, hydromorphone, meperidine - selection based on allergy cascade and used when the patient is not tolerating oral therapy, has breakthrough pain or refuses oral therapy), oral treatment (hydrocodone/acetaminophen, oxycodone/acetaminophen, tramadol selection based on allergy cascade and used when the patient tolerates oral therapy), and acetaminophen (for headaches, if allergic ibuprofen is used). If pain is not controlled, the physician increases the treatment level, i.e. Level B to Level C. If treatment causes over-sedation, the physician reduces the treatment level, i.e. Level C to Level B. The orders improve reproducibility, safety, and communication among our staff, while reducing telephone calls to clarify allergies, range orders, therapeutic duplication, and changes from IV to IM or PO when intravenous access is lost. The orders were initially implemented in surgery followed emergency and general practice.

Results: The medical staff at our facility is utilizing the orders in 79% of medical/surgical patients receiving opioid therapy. Patients treated for myocardial infarction and orthopedics were excluded, as we use specific pain treatment protocols in these populations. Therapeutic duplication has fallen from 68% pre-implementation to 5% post-implementation. An unexpected benefit has been the reduction of therapeutic duplication among physicians not using the orders down to 12%. Range orders have fallen from 55% to 5%. Another benefit was the reduction of meperidine utilization. Meperidine utilization has been reduced on a cost basis by 75% and a doses basis by 60%. Another benefit was noted during the injectable narcotic shortages. When morphine and hydromorphone were nationally backordered, with Medical Staff approval, we

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modified our cascade order depending on which injectable narcotic was available. We also opted to include nausea and vomiting medications (ondansetron/promethazine) on the orders to remove those duplications. The process has also simplified order entry both in pharmacy and via CPOE.

Conclusion: The new process has been very effective at addressing our challenges. Both the physicians and nurses were very supportive during implementation. Successful implementation required extensive education, a strong champion, time, and flexibility. Our orders went through a number of modifications prior to implementation and changed once since they were implemented. If they are installed in another facility, the medications selected and cascade order may vary depending on your medical staff. Medical staff involvement is essential to the success of the implementation.

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4-128

Category: Pain Management

Title: Effectiveness of liposomal bupivacaine in plastic surgery: a retrospective review

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Purpose: In November of 2011 the FDA approved liposomal bupivacaine as a result of two pivotal clinical trials demonstrating improved pain control and decreased opioid use compared to placebo in bunionectomy and hemorrhoidectomy. It is unknown if liposomal bupivacaine would provide comparable analgesia in patients undergoing plastic surgery where alternative modes of analgesia, such as epidural anesthesia and continuous incisional infusion with local anesthetics, are often utilized. The purpose of this analysis was to determine the opioid use in patients undergoing plastic surgery receiving liposomal bupivacaine versus prior standard of care at one community teaching medical center.

Methods: Patients who were admitted for observation or inpatient hospitalization after receiving liposomal bupivacaine for any plastic surgery from September 2013 through February of 2014 were included. A second cohort of patients who did not receive liposomal bupivacaine from March of 2013 through August of 2013 were matched according to primary ICD-9 procedure code, surgeon, and length of stay 1 day or > 1 day. Baseline demographics, including age, sex, weight, primary procedure as defined by ICD-9 code, and surgeon were collected, along with opioid use, length of stay, and use of epidural anesthesia. The primary endpoint was the mean total amount of morphine equivalents received during the inpatient hospitalization for each group. Secondary endpoints included length of stay and use of epidural anesthesia. Differences in mean opioid use and length of stay were calculated using a Students t-test. Differences in use of epidural anesthesia were determined with Fishers Exact Test.

Results: A total of 33 patients were given liposomal bupivacaine for a plastic surgery procedure during the study period, and were matched to 38 control patients. The primary plastic procedures in both groups were breast reductions, abdominoplasty, liposuction, deep inferior epigastric perforator (DIEP) flap, and transverse rectus abdominis myocutaneous (TRAM) flap. The mean opioid use was similar between the liposomal bupivacaine and control groups (62.82 mg vs 44.91 mg, $p=0.161$). There was no difference in average length of stay between liposomal bupivacaine and control groups (3.73 days vs 3.05 days, $p=0.059$). Eight patients in the control group received epidural anesthesia versus no patients in the liposomal bupivacaine group ($p=0.006$).

Conclusion: Opioid use and length of stay was similar in patients undergoing plastic surgery with the use of liposomal bupivacaine versus those who did not receive liposomal bupivacaine.

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However, the use of epidural anesthesia was greater in patients who did not receive liposomal bupivacaine.

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4-129

Category: Pain Management

Title: Is there any role for topical NSAIDs in mild to moderate musculoskeletal pain in a Lebanese community pharmacy?

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Purpose: Nonsteroidal antiinflammatory drugs (NSAIDs) are one of the most commonly prescribed drugs in the community pharmacy. Systemic administration of these medications is being misused by the patients who also reported significant adverse effects on the gastrointestinal and cardiovascular systems. Previous studies showed that short-term use of topical NSAIDs is effective in reducing pain with no systemic adverse events. The purpose of this study was to evaluate the role of topical NSAIDs in managing mild to moderate musculoskeletal pain versus systemic or combination of both dosage forms.

Methods: The Institutional Review Board of the Lebanese International University approved this prospective observational study that was conducted from January 2014 till May 2014 in a Lebanese community pharmacy. All patients on NSAIDs with mild to moderate musculoskeletal pain signed a written informed consent. Patients with severe musculoskeletal or other types of pain were excluded. Degree of pain was evaluated using numerical pain scale. Participants were divided into three groups according to the uptake of NSAIDs either topically, systemically or in combination of both routes. A follow-up period was started for all patients during therapy for up to 12 weeks. Patients knowledge about NSAIDs was assessed by the pharmacist before and after direct and/or indirect method of counseling. The primary outcome measure was to assess the efficacy of various NSAIDs routes for treatment success (defined as at least 50% reduction in pain), onset, and durability. The secondary outcome measures included assessing the efficacy of different NSAIDs topical dosage forms (gel, emulgel, difucrem), the safety profile of different NSAIDs routes, and the role of pharmacist in changing the level of patients knowledge about NSAIDs before and after providing different methods of counseling. The statistical tests used were post-hoc, chi-square, ANOVA, and logistic regression.

Results: A total of 149 patients were enrolled in this study. NSAIDs were administered topically 78 (52.3%), systemically 40 (26.8%), or in combination 31 (20.8%). The overall success of NSAIDs was reported in 132 participants distributed as 64 in topical, 37 in systemic, and 31 in combination. Logistic regression showed no significant difference in terms of efficacy between topical versus systemic (p-value= 0.99) and topical versus combination (p-value= 0.14). The mean onset of topical NSAIDs (17 minutes) was faster than systemic (30 minutes) with p-value of the mean difference <0.05, but slower than combination (15 minutes) with p-value= 0.28; also the onset of combination was faster than that of systemic p-value <0.05. The mean durability of

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systemic (10 hours) was longer than topical (7 hours) with p-value of the mean difference <0.05 , but shorter than combination (11 hours) with p-value= 0.85. No significant difference was seen between various dosage forms of topical NSAIDs and efficacy (p-value= 0.26). Patients who were on systemic NSAIDs (either alone or in combination) reported increase in blood pressure and gastric-upset 8 and 38 cases respectively. The total patients NSAIDs knowledge score was improved after counseling by 7.4 times using both direct and indirect compared to either method alone (p-value < 0.05).

Conclusion: According to our study, there was no statistical significance between NSAIDs dosage forms for the treatment of mild to moderate musculoskeletal pain in Lebanese community patients. Topical NSAIDs were faster in onset and effective in reducing pain with no significant adverse effects. Combination of topical and systemic NSAIDs routes showed faster onset and durability for pain reduction. Using both direct and indirect methods of pharmacist counseling have significantly increased the patients knowledge about NSAIDs.

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Category: Pain Management

Title: Impact of IV acetaminophen on opioid analgesic use and patient outcomes in the adult peri-operative setting: a 9-hospital retrospective evaluation

Primary Author: Oscar Guzman; Email: oscar.guzman@cardinalhealth.com

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Purpose: IV acetaminophen is approved for the management of mild-to-moderate pain and the management of moderate to- severe pain when used in combination with opioid analgesics. IV acetaminophen has been associated with decreased use of opioid analgesics in orthopedic and abdominal surgeries, compared to placebo. Studies evaluating the impact of IV acetaminophen on patient outcomes have yielded inconsistent results. The purpose of this study was to determine if IV acetaminophen use had any effect in decreasing opioid use in adult surgery patients and to evaluate the impact on patient outcomes.

Methods: We conducted a retrospective drug use evaluation of IV acetaminophen in the peri-operative setting of 9 US hospitals between July and October 2013. Men and women aged 18 to 75 years were included in the analysis. Data was collected for the first 30 patients at each site receiving IV acetaminophen during the study period (treatment group). Comparative data for a control group of 30 consecutive adult surgery patients that did not receive IV acetaminophen was also collected. Data collected for each patient included; de-identified patient and hospital demographics, surgery type, inpatient status, comorbidities, adverse drug events (ADEs), individual non-opioid and opioid analgesic drug name, dose, frequency and duration. All individual opioid doses were converted to IV morphine equivalents (MEs) for comparison. Outcomes evaluated included; time to extubation, time to oral diet, time to ambulation, post-operative acute care unit (PACU), intensive care unit (ICU) and hospital length of stay (LOS). Data were analyzed using R (The R Project for Statistical Computing, V. 3.1.0) and Tableau (8.1).

Results: A total of 253 patients were evaluated in the treatment group and 213 in the control group. Both groups were allowed to receive oral acetaminophen with a mean total dose of 1.38gm plus/minus 1.47gm and 1.55gm plus/minus 2gm, in the control group and treatment group, respectively. The mean total dose of IV acetaminophen in the treatment group was 1.67gm plus/minus 1.2gm. A total of 651 IV morphine equivalent doses were administered in the control group (mean dose equals 14.5mg plus/minus 15.3mg) compared to 599 doses in the treatment group (mean dose equals 14.4mg plus/minus 21.2mg, p equals 0.93). The mean doses administered in the control and treatment arm were 35.76 mg and 38.98 mg, respectively (p equals 0.38). The most common ADE was post-operative nausea and vomiting. Patients in the IV acetaminophen treatment group experienced more post-operative ileus and itching or rash, while

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patients in the control group were more likely to experience hypotension or respiratory arrest. No clinical correlation was identified between ADEs and use or lack of use of IV acetaminophen. There were no statistical differences in time to extubation, time to ambulation, PACU LOS, ICU LOS or overall Hospital LOS between the two groups.

Conclusion: IV acetaminophen was not associated with a decrease in opioid analgesic use or with improved mean time to extubation, time to ambulation, PACU LOS, ICU LOS or overall Hospital LOS between the two treatment groups. Given the clinical and economic evidence available, IV acetaminophen may be considered in the limited number of patients who are undergoing abdominal surgery and who cannot receive drugs orally or rectally and cannot tolerate opioids or other oral or parenteral non-opioid analgesics.

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Category: Pediatrics

Title: Antithrombin III replacement in infants: does it make a difference in heparin resistance?

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Purpose: Antithrombin III (ATIII) is an important component of anticoagulation. Limited data exists with the use of ATIII in infants for heparin resistance. The purpose of this study is to describe the safety and efficacy of ATIII in infants.

Methods: The institutional review board approved this retrospective cohort study of patients younger than 1 year of age who received ATIII (Thrombate III) between 09/2010 to 11/2013. Patients were included if they received ATIII and have a baseline ATIII level within 72 hours before and after receiving the first ATIII dose. A p-value <0.05 was considered statistically significant.

Results: The study included 139 patients --50% (n=72) achieved a goal ATIII level >80% after the first dose of ATIII and 80% (n=111) were on a continuous heparin infusion. Within 1 hour and 12 hour of ATIII, 5% (n=6) and 12% (n=13) of patients had a reduction in heparin dosing, respectively. A bleeding event was experienced in 25% (n=35) of the cohort patients on extracorporeal membrane oxygenation (ECMO) were more likely to experience a bleeding event (p<0.01). A subgroup analysis of patients who did and did not achieve goal ATII levels revealed that patients who achieved goal levels had a higher baseline ATIII level (p<0.01), were administered a higher ATIII dose (p<0.01) and were more likely to be on ECMO (p=0.01) than the cohort who did not achieve goal ATIII levels.

Conclusion: The use of ATIII did not allow for a significant decrease in the dose of heparin infusion in the majority of patients while potentially introducing a significant risk of bleeding.

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4-132

Category: Pediatrics

Title: Pour some sugar on me: overuse of sucrose in a neonatal intensive care unit

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Purpose: Multiple studies document the efficacy of sucrose for the use of pre-procedural pain relief when administered prior to minor procedures in neonates. Anecdotal reports within our unit suggested that sucrose was being used for purposes other than those for which it was ordered and in quantities greater than what is considered acceptable. We sought to define the use of sucrose in our unit and to reduce any use that we determined to be inappropriate through education of our nursing staff.

Methods: Sucrose is not charted by nursing in our unit so measuring the amount and indication of sucrose for individual patients was not an option. Instead, we opted to survey nursing staff to determine both baseline knowledge of and use of sucrose. We then sought to educate nurses on the appropriate use of sucrose including the potential adverse effects of overuse of sucrose. Following this education we re-surveyed staff. Furthermore, we evaluated purchase data, comparing the time period leading up to and following our intervention.

Results: Initial survey results indicated excessive overuse of sucrose in our unit as well as lack of knowledge of appropriate sucrose use demonstrated by the 35% who acknowledged using sucrose outside of prescribed indications and 35% who claimed no knowledge of the specifics of the order for sucrose. Seventy percent of respondents to the follow up survey acknowledge receiving education on sucrose. The belief that sucrose is a medication increased from 54% on initial survey to 86% at follow up. On the initial survey on 30% of nurses who responded were familiar with the order and used sucrose only as ordered compared to 76% on follow up. The rate of intentional use outside of the order decreased by a corresponding amount. Overall ordering of sucrose from the warehouse did not appear to be affected but was not adjusted against the daily census and may not directly correspond to use in individual patients.

Conclusion: Although through education we were able to reduce inappropriate use of sucrose in our unit, there is still much room for improvement. Based on the follow up survey results we plan to incorporate recommendations such as: changing the product that we carry to a unit of use size rather than a cup as well as better ways to provide more extensive education that will reach more of the staff.

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4-133

Category: Pediatrics

Title: Evaluation of remifentanil utilization in the pediatric intensive care unit

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Purpose: Remifentanil is a short acting opioid that is used most commonly in adjunct with other medications for general anesthesia, rapid sequence intubation, operating room (OR) extubation and sedation. With a terminal half-life of ten to twenty minutes, remifentanil is an ideal opioid to use when a patient requires awakening trials during their course. The objective of this study is to assess the indications for use and the overall safety and cost profile of remifentanil infusion in patients admitted to the pediatric intensive care unit (PICU) at Nationwide Children's Hospital.

Methods: Retrospective review of electronic medical records and laboratory data in PICU patients who received remifentanil infusion from October 2012 through October 2013. Patients were excluded if they did not receive remifentanil infusion after drug was dispensed. Data collected: age, gender, remifentanil indications, minimum and maximum infusion rates of remifentanil, duration of therapy, transitions to other analgesics at discontinuation of remifentanil, and adverse effects reported in the electronic medical records while patient was receiving remifentanil.

Results: The study included 28 patients. The most common indication for remifentanil use was sedation in PICU patients with traumatic brain injury (TBI). Some other indications included sedation in patients undergoing neurosurgical procedures and patients with refractory seizures. Mean minimum remifentanil infusion rate was 0.13 mcg/kg/hr, mean maximum remifentanil infusion rate was 0.35 mcg/kg/hr, and mean duration of therapy was 23.3 hours. Patients were transitioned to a variety of analgesics at the time of remifentanil discontinuation including fentanyl continuous infusions, PCAs/NCAs, and other opioid and non-opioid regimens. There were five PICU patients who experienced bradycardia, hypotension, and/or decreased respiratory rate during remifentanil infusion. When cost of remifentanil was compared to that of fentanyl at a conversion ratio of 1:2 based on dose equivalence, the mean cost of remifentanil was \$614.03 and the mean cost of fentanyl was \$219.71 with a total cost difference of \$13,012.67.

Conclusion: Remifentanil has been used in PICU patients across a wide range of age groups at Nationwide Children's Hospital with the main indication of sedation in patients with TBI. Doses of remifentanil were started at a normal or low dose based on indication and were titrated appropriately. Patients were transitioned to different analgesic regimens at time of discontinuation of remifentanil infusion. The overall cost difference of remifentanil infusion when compared to an equivalent dose of fentanyl infusion was more expensive. Most patients

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tolerated remifentanyl infusions well; a few patients experienced bradycardia, hypotension, and/or decreased respiratory rate during remifentanyl infusion.

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4-134

Category: Pharmacokinetics

Title: Effect of vancomycin loading doses on time to therapeutic level

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Purpose: The Infectious Diseases Society of America (IDSA) et al states vancomycin troughs of 15 milligrams per deciliter must be maintained to eradicate methicillin resistant staph aureus (MRSA) when minimum inhibitory concentrations (MICs) equal 1. Despite escalating national trends in vancomycin MICs with MRSA, IDSA recommends loading doses for only seriously ill patients. A community hospital reported MRSA vancomycin MICs of at least 1 and identified the need to reach therapeutic levels quickly to optimize outcomes. The study objective was to compare therapeutic levels at first drawn trough and adverse events with traditional versus loading dose groups.

Methods: Appropriate medical staff approval was obtained prior to beginning a 3 month vancomycin loading dose pilot program. The pilot included all inpatients 18 years and older receiving vancomycin dosed by the pharmacist managed pharmacokinetic dosing service. Patients who received the first dose of vancomycin prior to pharmacy consult, received pulse dosing for renal dysfunction, or never reported at least one vancomycin trough were excluded. Pulse dosing was defined as those patients receiving dialysis, reporting a baseline serum creatinine greater than 2 milligrams per deciliter, or age greater than 70 years plus weighing less than 50 kilograms. Once a patient met criteria for a vancomycin loading dose, 25 milligrams per kilogram with a maximum of 2 grams was administered. At the conclusion of the pilot program, retrospective data collection compared patients who were a part of the traditional dosing group (TDG) 3 months prior to the pilot and the loading dose group (LDG). The primary study endpoint was the percentage of patients in therapeutic range by the first and overall vancomycin troughs. The secondary safety endpoint was the percentage of patients with acute renal failure defined as 0.5 milligram per deciliter or 50 percent increase in baseline serum creatinine.

Results: A total of 153 patients were reviewed, including 77 TDG and 76 LDG patients. The primary endpoint demonstrated that 15 of 77 patients (20 percent) in the TDG compared with 24 of 76 patients (32 percent) in the LDG were therapeutic at the first trough level with a minimum vancomycin trough of 15 milligrams per deciliter. When all vancomycin trough levels were compared, 21 of 77 patients (27 percent) in the TDG and 32 of 76 patients (42 percent) in the LDG reached the minimum vancomycin trough level. Patients with acute renal failure were 4 of 77 (5 percent) in the TDG and 2 of 76 (3 percent) in the LDG.

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Conclusion: Vancomycin loading doses increased the percentage of therapeutic levels at first trough without an increase in acute renal failure when compared with traditional dosing.

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4-135

Category: Pharmacokinetics

Title: Effect of genetic polymorphism of CYP3A5 and CYP2C19, and concomitant use of voriconazole on the blood tacrolimus concentration in patients receiving hematopoietic stem cell transplantation

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Purpose: Tacrolimus (TAC) concentration in the blood should be monitored to maintain adequate exposure and preventing drug-related toxicities following hematopoietic stem cell transplantation (HSCT). However, the variability of blood TAC concentration at an early stage of HSCT is as of yet still difficult to predict. We previously reported a case strongly suggesting the contribution of CYP3A5 and CYP2C19 polymorphisms on the variability of blood TAC concentration (Clin Ther. 2011). This study was conducted to assess the variability due to the hepatic metabolic activity of CYP3A and CYP2C19 based on genetic polymorphisms and drug interactions in HSCT recipients.

Methods: This study was a single-institute, retrospective study comprised of 21 adult recipients who underwent HSCT between January 2009 and March 2014. TAC was initially administered by 24 h continuous infusion at a dose of 0.02 mg/kg starting on day -1 until at least 21 following HSCT. The dose of TAC was adjusted to maintain the optimal concentration range of 10-15 ng/ml. The presence of mutant alleles at exon 5 (CYP2C19*2) and/or exon 4 (CYP2C19*3) for CYP2C19, and intron 3 (CYP3A5*3) for CYP3A5 were examined using the multiplex extension of unlabeled oligonucleotide primers with fluorescently labeled dideoxynucleotide triphosphates. The changes of blood TAC concentration/dose (C/D) ratio and TAC dose reduction from initial dose following HSCT were measured to assess the influence of genetic polymorphisms of CYP3A5 and CYP2C19 on TAC pharmacokinetics. The effect of concomitant application of CYP3A inhibitors was also assessed. The nonparametric Mann-Whitney U-test and Fisher's exact test were used to analyze differences of quantitative or categorical data from 2 groups, respectively. This study was approved by the Ethics Committee of Mie University, and a written informed consent was obtained from each subject.

Results: Significant differences between HSCT recipients with CYP3A5*1 allele and CYP3A5*3/*3 genotype were observed with respect to the median TAC C/D ratio on day 14 (563 vs. 742, $p < 0.01$) and day 21 (672 vs. 777, $p < 0.05$) following HSCT. As for CYP2C19, there was no significant difference in the respective TAC C/D ratios of the extensive metabolizer

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(CYP2C19*1/*1), and either the intermediate (CYP2C19*1/*2 or *1/*3) or poor metabolizer (CYP2C19*2/*2 or *2/*3). Concomitant use of voriconazole (VRCZ), a CYP3A inhibitor, was also found to significantly increase the TAC C/D ratio on day 14 (557 vs. 723, $p < 0.01$). We also found that the median TAC dose reduction ratio from day -1 to day 21 was significantly higher in recipients with CYP3A5*3/*3 genotype (22.0%) as compared to recipients with CYP3A5*1 allele (5.9%), whereas VRCZ had no significant influence. In HSCT recipients with CYP2C19*1/*1, the TAC dose reduction was less than 15% even in a recipient with CYP3A5*3/*3 genotype and receiving VRCZ. The serum trough VRCZ concentrations in the two HSCT recipients harboring CYP2C19*1/*1 were less than 1.0 $\mu\text{g/ml}$ (0.72 and 0.63 $\mu\text{g/ml}$, respectively).

Conclusion: The variability of blood TAC concentration delivered via intravenous administration in recipients with HSCT is explained in part by the genetic variation of CYP3A5. Our results also strongly imply that the magnitude of the interaction between TAC and VRCZ is affected by the genetic polymorphism of both CYP3A5 and CYP2C19 genes. Our findings may provide useful information for constructing a standard way to optimize blood TAC concentration in HSCT recipients receiving intravenous administration. Ultimately, this work should be of considerable interest to healthcare workers concerned with the safe management of TAC therapy for organ transplantations and autoimmune diseases.

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4-136

Category: Pharmacy Law / Regulatory / Accreditation

Title: Formalized practice agreements associated with fewer pharmacist-perceived barriers to providing services beyond dispensing

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Purpose: Pharmacists are commonly seen as the most accessible health care professionals, and are trained to provide a range of medication-related services shown to decrease medication related problems and improve health outcomes. However, despite the significant impact these services can have on patient outcomes, little evidence exists in the literature quantifying and describing direct patient care services provided by pharmacists, or determining factors associated with pharmacist participation in these services.

Methods: A survey was constructed to assess pharmacist direct patient care services. The primary objective was to examine the relationship between pharmacist involvement and perceived barriers to providing these services. Secondary analyses identified whether any pharmacist-specific characteristics predicted participation in direct patient care services. Descriptive statistics were performed on the most common types of services, specialty areas and practice settings in which services are provided. Institutional Review Board approval was obtained, and the survey was distributed in the state of Florida via the email list-serves of two professional organizations.

Results: One hundred and seventy-one pharmacists completed the survey (56.7 percent female). The most common age groups for respondents were less than 45 years of age (24.0 percent less than 35, and 23.4 percent between 35 and 44 years of age); most who responded were in practice greater than or equal to 12 years (59.6 percent). Thirty-seven percent of pharmacists reported working within a formalized practice agreement to provide direct patient care services. Pharmacists working through Prescriber Care Plans reported fewer perceived barriers to providing direct patient care services than those not working through formalized practice agreements (P equals 0.025). The most common types of direct patient care services provided were: identifying drug-drug interactions (89.5 percent), drug-allergy interactions (87.7 percent), or duplicate or unnecessary medications (86.5 percent); recommending dose adjustments (83.6 percent); and assessing the appropriateness of dose, dosing regimen, and duration of therapy (81.3 percent). The most common disease-state areas in which services were provided were anticoagulation (56.1 percent), diabetes (47.4 percent) and heart failure (41.5 percent); and the most common specialty areas were internal medicine (34.5 percent), primary care (29.8 percent) and infectious diseases (29.8 percent). No pharmacist-specific characteristics were predictive of involvement in direct patient care services.

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Conclusion: Among survey respondents in Florida, formalized practice agreements were associated with fewer pharmacist perceived barriers to providing direct patient care services. These findings suggest legislative framework that supports pharmacist involvement in direct patient care services may increase pharmacist participation in these services, which as shown in previous work, could lead to improved patient outcomes within the healthcare system.

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4-137

Category: Pharmacy Technicians

Title: Use of a pharmacy technician to facilitate post-fracture care provided by clinical pharmacy specialists in a primary care setting

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Purpose: To assess the ability of a pharmacy technician to screen patients for pharmacist intervention and, when applicable, collect patient-specific clinical information as a method to facilitate care provided through a pharmacist-driven osteoporosis management service.

Methods: This was a two phase prospective study of women aged 65 or older who suffered a fracture and received care between June 1, 2012 and March 31, 2013 through the pharmacist-driven osteoporosis management service. Clinics participating in the study received assistance from a pharmacy technician to review patients and collect information related to the fracture and the patients risk for osteoporosis. Phase I and II study end points were pharmacy technician accuracy and pharmacist time saved, respectively.

Results: A total of 127 patients were reviewed by the pharmacy technician in Phase I. The pharmacist agreed with the pharmacy technicians determination for pharmacist intervention in the majority of instances (92.9%). There were 91 patients reviewed by the pharmacy technician in Phase II. With the assistance of the pharmacy technician, for patients not requiring pharmacist intervention, the time spent on review was 5.0 3.8 minutes compared to 5.2 4.5 minutes through usual care ($p = 0.78$). For those requiring intervention, the time spent on care plan development was 13.5 7.1 minutes compared to 18.2 16.6 minutes through usual care ($p = 0.34$).

Conclusion: Results of this study suggest that a pharmacy technician can accurately determine if a patient is a candidate for pharmacist intervention as well as collect many pieces of clinical information. Although not statistically significant, time spent reviewing patients and developing care plans was reduced in medical offices receiving the assistance of the pharmacy technician.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Comparing a top-down therapy approach with infliximab to conventional step-up therapy in moderate-severe Crohns disease: a budget impact analysis

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Purpose: The purpose of this research is to assess the clinical and economic impact of a top-down therapy approach in moderate to severe Crohns disease patients from the perspective of a third party payer. A top-down therapy approach that is initiated early in disease progression has been associated with longer rates of remission and decreased need for hospitalization and surgery. However, due to the significant cost of this treatment, a budget impact analysis is needed to assess what role this therapy can play in a realistic clinical setting.

Methods: We conducted a literary search using PubMed, Medline, Ebsco, and Medscape and found 36 articles to assess clinical efficacy and 30 articles to assess economic impact. Moderate to severe Crohns disease was defined as a Crohns disease activity index of 220 to 450 in accordance with the American College of Gastroenterology Guidelines. We eliminated articles from analysis if infliximab was not considered the biologic agent of choice. A budget impact analysis was then conducted using a cost calculator approach with a one-way sensitivity analysis to minimize error. All prices were converted to USD and were inflated to 2012 to reflect uniform and accurate costs. Using a 5-year time horizon, we were able to extrapolate costs of conventional step-up and top-down therapy. In addition, we were able to estimate and compare costs of hospitalizations, surgeries, and extra-intestinal complications for each therapy. After finding the costs, an estimate total savings was calculated to determine which therapy is more appropriate in terms of clinical and economic benefit.

Results: Top-down therapy with infliximab was associated with long rates of steroid-free clinical remission, improved mucosal healing, and delayed time to surgery when compared to conventional step-up therapy. After using the budget impact model we constructed, it was determined that top-down therapy with infliximab could save budget holders, on average, \$16.27 million per year, or \$83.83 million over a five-year time horizon. Per patient, these costs equate to \$2,600 per year or \$13,609 over five years. Even when accounting for overweight or obese patients who would require a higher dose of infliximab, we found that a top-down approach saved budget holders more money when compared to step-up. The driving factor for cost savings with infliximab was the significantly lower rate of surgeries, which accounted for the substantial cost savings when compared to step-up therapy.

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Conclusion: Infliximab is associated with improved rates of steroid-free clinical remission, mucosal healing, and decreased need for surgery. From an economic standpoint, infliximab reduces costs associated with surgeries, hospitalizations, and disease state complications. It should be noted that all patients with Crohns disease should have individualized therapy based on co-morbid conditions and tolerability to specific therapies. However, this budget impact analysis shows that infliximab should be considered as a first line option in this patient population as a cost effective measure with a significant improvement in patients quality of life.

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4-139

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of a 4-month introductory pharmacy practice experience (IPPE) on pharmacy students interprofessional beliefs, attitudes, and behaviors

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Purpose: Recent efforts to enhance student preparation for interprofessional practice have challenged many academic institutions to identify effective strategies and models for introducing and developing interprofessional competencies and values among their students. Introductory Pharmacy Practice Experiences provide pharmacy students with opportunities to partake in direct patient care early in their curriculum and to begin to develop competencies needed to deliver team-based health care. The goal of this project was to evaluate the impact of IPPE on pharmacy students interprofessional beliefs, attitudes, and values using a validated Interprofessional Socialization and Values Scale (ISVS).

Methods: Northeastern University has a rich long-standing history of practice-oriented education using a world-renowned cooperative education model. An IPPE experience at Northeastern University's School of Pharmacy can be defined as a 4-month, full-time, 640-hour experiential learning experience in a hospital, community, or another pharmacy setting. Nearly all of the students are employed by their IPPE site, which allows them to fulfill all typical responsibilities of pharmacy interns and participate in the direct patient care. The ISVS is a 24-item validated instrument with 3 sub-scales: 1) self-perceived ability to work with others (9 items to assess beliefs), 2) value in working with others (8 items to assess attitudes), and 3) comfort in working with others (6 items to assess behaviors). The ISVS asks respondents to rate the extent to which a belief, behavior, or attitude is present, using a 7-point Likert scale (1=not at all to 7=to a very great extent). ISVS was administered before and after the first IPPE to pharmacy students in their first professional year. The responses on both surveys were compared to each other using Mann-Whitney U test.

Results: Survey was completed by 123 (86%) before and 119 (88.8%) after IPPE. Among respondents on the post-survey, 48.7% completed an IPPE in a community setting, 43.7% completed an IPPE in a hospital setting, with the remainder completing an IPPE at a different practice setting. Average ratings for each sub-scale increased post-IPPE: for sub-scale 1 average rating increased from 5.15 to 5.68; for sub-scale 2 from 5.43 to 5.85; and for sub-scale 3 from 5.10 to 5.78. Relatively high pre-IPPE average ratings on all items of the ISVS scale demonstrated students early understanding of the value of interprofessional teamwork. Despite of this, there was a statistically significant improvement ($P<0.05$) on all but 7 items (3 in sub-scale 1 measuring beliefs, 1 in sub-scale 2 measuring attitudes, and 3 in sub-scale 3 measuring behaviors) on the post-survey.

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Conclusion: Our IPPE model provides students with an early opportunity to build interprofessional competencies and values needed for effective team based patient care as evident by the improvement of values and beliefs measured by the ISVS scale. The ISVS scale may be a useful tool to measure students interprofessional attitudes throughout the didactic and experiential learning.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: The implementation of an advance pharmacy practice experiential student program at a supply chain management organization

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Purpose: To create an advance pharmacy practice experiential program that engages a student to develop their pharmacy practice management skills through active participation in pharmacy initiatives at a supply chain management organization.

Methods: A rigorous curriculum was created to allow the student to actively participate in a variety pharmacy supply chain operations with a special focus on: data analysis, medication utilization evaluation, pharmacy contracting, drug shortages, member support, cost analysis, pharmacy operations, business development, marketing, leadership, and research. The student was assigned a single specific project within each area. Each project was managed and evaluated using a propriety productivity development tool designed for this APPE program. The students impact was assessed for each project on a weekly basis for savings, cost avoidance and value-add to overall SCM membership. In addition, weekly readings and summations, at least two journal clubs, evidence based research and drug information support were also assigned. The student attended all contracting, operations and leadership meetings during the rotation.

Results: The APPE student was assigned twelve projects including a major project that was managed using the productivity development tool. Eleven of these projects were completed within the 6-week rotation period. The major project resulted in a measurable savings of \$74,000.

Conclusion: This was the first supply chain management advance pharmacy practice experiential rotation available to pharmacy students at Northeastern University. The advance pharmacy practice experiential student provided measurable impact to the supply chain management organization.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Applying an extended dosing strategy of piperacillin/tazobactam to improve both clinical and cost effectiveness in the milieu of a drug shortage

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Purpose: To implement extended dosing strategies of piperacillin/tazobactam to address a drug shortage and realize savings within a group purchasing organization.

Methods: As of April 2, 2014, there has been an on-going drug shortage reported by ASHP for piperacillin/tazobactam. It is well established that an extended dosing (ED) strategy for piperacillin/tazobactam is non inferior to the traditional dosing (TD) strategy. When applied, ED will reduce the dosing regimen by one dose. Methods: A literature search was conducted on PUBMED using the following search words: piperacillin, tazobactam and extended infusion yielded 31 articles. 8 articles met criteria for inclusion. A comparison grid demonstrated either non inferiority or superiority of ED strategy over TD strategy with exceptions in obese critically ill patients. Wholesaler purchase data was accessed to identify hospital acquisition trends for piperacillin/tazobactam. The hospitals included in the study were members of the same GPO for entire study period and purchased piperacillin/tazobactam within the same contractual pricing agreement. A cost analysis was performed utilizing a proprietary data analysis tool to characterize a usage report and shortage impact for the each facility. A summary of article comparison and shortage impact was presented to hospitals as an incentive to adopt an extended dosing strategy to address shortage while maintaining clinical efficacy.

Results: A disproportionate share, 340b hospital was identified as purchasing frozen Zosyn and affected by shortage. Extended infusion was implemented for all frozen product. The 25% usage reduction resulted in an annualized savings of \$74,672.28.

Conclusion: ED strategy is a viable option of addressing a piperacillin/tazobactam shortage while maintaining clinical and cost effectiveness.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Barriers and concerns surrounding Pharmacist initiated point-of-care (POC) testing: state executives perspectives

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Purpose: Expanded use of point-of-care (POC) testing in community pharmacy settings has the potential to improve access to care and benefit patient and public health.¹ Some POC testing has been done in pharmacy settings for three decades. It is not always clear, however, which tests can be performed legally in each state. The primary objective of this research is to gain insight on association leadership views and concerns surrounding point-of-care testing, discuss resources that would be useful in addressing these concerns, identify POC tests that are being performed by pharmacists and assess the legality of pharmacists performing POC testing and dispensing per protocol based on state laws.

Methods: The institutional review board (IRB) approval was granted (IRB # 287-14-EX). Inclusion criteria are: subjects 18 years of age and older, a National Alliance of State Pharmacists Associations (NASPA) executive, and scheduled to work during the month of May 2014. There were no restrictions based on gender, race or ethnicity. A cover letter was constructed to explain the intent of the research. A letter of support was obtained from Dianne Miller, RPh; Michigan Pharmacists Association. NASPA members received an electronic cover letter via email using Qualtrics software through a secure electronic network. The survey and letter of support were embedded in the email. NASPA members who provided consent were enrolled and could choose to complete all or part of the survey questions. Following a one-week waiting period, all executives who had not completed the survey were sent a reminder email.

Results: Seventeen out of the 50 of state executives consented and completed the survey (34%). 63% of responding state executives rank their memberships knowledge of POC testing low or very low. All state executives agreed that their membership would be interested in learning more about POC testing. Thirteen (76%) executive reported that less than 20% of pharmacies are conducting some sort of POC testing in their state. POC tests have the potential to improve access to care and benefit patients. Currently blood glucose, lipid panels and influenza are the most common POC tests being performed by pharmacists. Thirteen of 17 state executives said that it is legal for a community pharmacist to perform POC testing in their state and 9 (53%) said it was legal for community pharmacists to dispense per protocol. The inability to get paid, lack of provider status, and the lack of a defined workflow were the most commonly reported barriers surrounding POC testing.

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Conclusion: While there is variation in utilization and regulation of POC testing across the country, common elements were reported by state association executives. First, knowledge of and use of POC testing is low. Also, there is a recognized need for further education and training of pharmacists about POC testing. Finally, the policy and payment issues must be considered to improve adoption of POC testing.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Budget impact analysis of dimethyl fumarate as a second-line agent in relapsing-remitting multiple sclerosis: a third-party payer perspective

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Purpose: Relapsing remitting multiple sclerosis (RRMS) has a significant impact on quality of life and costs in the US. Approximately one-third of patients with RRMS that are initiated on treatment with interferon agents fail therapy, leading providers to consider alternative agents. Dimethyl fumarate, a second-line agent approved for RRMS, is an appealing option to many patients because of its tolerable side effect profile in comparison to alternative agents. The purpose of this analysis is to evaluate clinical and cost-effectiveness data related to dimethyl fumarate compared to other approved second-line agents for RRMS from the perspective of MassHealth, a Massachusetts Medicaid program.

Methods: A clinical and economic literature review was conducted with PubMed and Medline to compare the impact of dimethyl fumarate with other commonly prescribed second-line agents including teriflunomide, fingolimod, and natalizumab. A total of 70 clinical efficacy articles and 135 economic impact articles were found. Articles were eliminated from each search if there were duplicates or if the comparators were only first-line agents. Following the literature search, a population-based budget impact analysis (BIA) was performed to assess the impact of dimethyl fumarate from the perspective of MassHealth insurance as the budget holder. The target population was the subgroup of patients with RRMS deteriorating on one of the first-line disease-modifying therapies (DMT's). Failure of first-line therapy was either due to suboptimal response to treatment or a rapidly evolving form of multiple sclerosis. Inputs to calculate the BIA included annual drug, hospital, ambulatory care, adverse event, and relapse-related costs. A subsequent univariate sensitivity analysis was then completed to account for uncertainty in the data. A range of 20% was used from the base case to account for variability within each domain.

Results: Based on two phase 3 studies (DEFINE and CONFIRM), dimethyl fumarate significantly reduced the rate of relapses in patients with multiple sclerosis versus placebo by 53% and 44%, respectively. A systematic review demonstrated that dimethyl fumarate was associated with improved efficacy compared to other RRMS agents with the exception of natalizumab, and resulted in fewer serious adverse events. Additionally, dimethyl fumarate was associated with an incremental cost per QALY of less than \$46,000 when compared with interferon agents, glatiramer acetate and natalizumab. Based on inputs used to evaluate the BIA,

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transitioning RRMS patients on MassHealth using second-line DMT's to dimethyl fumarate resulted in an annual cost savings of \$2.5M, \$1.5M, and \$1.4M compared to the use of natalizumab, fingolimod, and teriflunomide, respectively. This resulted in an average annual cost savings of \$1.8M. The sensitivity analysis demonstrated that costs of relapse treatment, ambulatory care, hospital care, drugs, and adverse events had limited effect on the budget impact; however, variations in population size may affect cost-savings.

Conclusion: Based on the results of the BIA, dimethyl fumarate demonstrated cost-saving benefits from the perspective of third-party payers, including MassHealth. The ease of administration and minimal adverse events associated with dimethyl fumarate make it an appealing agent for both third-party payers and patients seeking treatment.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Simple and short-duration dosing schedules improve patient adherence to oral anti-infectives

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Purpose: Inpatient length of stay for serious skin infections averages 4.2 days (Healthcare Cost and Utilization Project, 2011), but treatment courses for current antibiotics range from 5-14 days, thus requiring most patients to complete their antibiotic regimen as outpatients. Once a patient leaves the hospital, adherence to antibiotics might decrease due to missed doses and/or premature treatment discontinuation. Diminished adherence can contribute to treatment failure and antibiotic resistance. A review of studies examining adherence in adults treated with short-term, anti-infective oral drugs was conducted.

Methods: PubMed was systematically searched for English publications on or before Jan 21 2014 for studies of adherence by dosing frequency/duration in adults treated with short-term (< 4 weeks) anti-infective oral drugs. Because of the focus on patient adherence, studies of adherence support programs and of hospitalized patients were excluded. Outcomes of interest were the effect of dosing frequency and duration on patients adherence to therapy.

Results: Eighteen studies met the criteria for evaluation. The most common outcomes identified were percentage of pills taken vs prescribed, percentage of patients taking all prescribed pills, percentage of patients taking at least a given percentage (e.g., 80%) of prescribed pills, number of days with correct dosing, and percentage of correct dosing intervals. Most studies, particularly those that measured adherence using electronic monitoring or pill counts rather than patient self-report, found higher adherence with lower dosing frequency. For example, 9 of 11 studies found better adherence with once-daily versus twice-daily dosing. In regimens dosed multiple times a day, patients more often forgot the afternoon and evening doses than the morning dose. In two studies that directly compared the effect of duration on regimens dosed once or twice daily, adherence began to decrease after day 3 of therapy with a more pronounced decrease observed with twice daily regimens compared to once daily schedules.

Conclusion: Adults are more likely to adhere to oral anti-infective regimens with once-daily dosing and short treatment duration. For serious skin infections and other conditions requiring short-term anti-infective therapy where treatment typically begins in the hospital, physicians may want to consider therapies with simple and short-duration dosing schedules to minimize the risk

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of reduced patient adherence during the outpatient portion of treatment. Additional research examining the link between antibiotic treatment adherence and treatment success is needed.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Interprofessional education: establishing a collaborative pharmacy-medicine research program

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Purpose: Given that medical research is vital to the progress of evidence-based medicine (EBM), it is imperative that healthcare students and professionals understand how to assess medical literature and conduct clinical research. A strong research foundation can aid in judging study merit and making clinical practice decisions. Interprofessional collaboration (IPC), where students from two or more professions learn from and with each other, is an important model in medical education. This study was conducted to determine the impact of an IPC research certificate program in improving the competence of healthcare residents and students in interpreting medical research.

Methods: Our study utilized the before-and-after study design in which an eight-hour research certificate program was provided to internal medicine residents and students as well as pharmacy residents. The program conducted by two seasoned clinical pharmacists with significant research experience. The program was divided into four, two-hour topic lectures, including 1) statistical concepts and clinical trial design, 2) developing research questions and abstract writing, 3) developing and performing platform and poster presentations, and 4) grant writing/submission and manuscript development. Before and after attending the program, participants were asked to complete the Fresno test, a validated educational tool designed to assess knowledge of basic EBM concepts. Changes in test scores were used to assess the impact of the program on research competence. Participants were required to attend all four lectures in order to be included in the study, and each participant served as his or her own control. Test scores were evaluated using the students T test for analysis. To assess program quality, an anonymous survey based on a four point-Likert scale was completed by participants after conclusion of the program.

Results: The program was open to 38 participants and a total of 20 healthcare residents and students completed the program. EBM knowledge scores on the 212-point Fresno test increased from an mean baseline score of 97.7 (46%) to 133.7 (63%) ($P < 0.001$) upon completion of the program. Median Fresno test scores (interquartile range) were 99 (69|167) pre-program and 130 (74|206) post program. Every participant completed the anonymous survey to assess program quality. A total of 80% of surveys returned with the highest ranking (category four) for the quality of the program and the faculty.

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Conclusion: An IPC research certificate program significantly increased EBM research knowledge, as evaluated by a validated research test. IPC research certificate courses should be considered for incorporation into both medical and pharmacy resident training programs.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Simple steps to managing transdermal patches safely in hospitals

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Purpose: Incorrect use of transdermal patches can and has resulted in significant patient harm, including death. An extensive review of international literature failed to identify comprehensive recommendations to minimise the risk of patient harm while still ensuring maximum patient benefit. A hospital subgroup was set up to review all aspects of transdermal patch usage and multi-disciplinary guidelines to ensure safe use were developed in-house and disseminated to all hospitals in the state. The aim of this process was to produce easy to use guidance for staff which would promote safe practices in all aspects of patch use, including prescribing, application, documentation, removal and disposal.

Methods: A patient-focused group addressed all safety concerns around transdermal patch usage and subsequently developed guidelines using best practice points cited in the literature as well as innovative practice-based elements developed locally. The guidelines identified the roles of each healthcare professional in their patients safety and care.

Results: Web-based guidance has been developed to inform all healthcare staff of the potential dangers and necessary safety procedures required each time a transdermal patch is used. The guidance is easily and readily accessible by all staff hospital-wide. Since implementation there has been a decrease in the number of patch-related medication errors reported. A retrospective quantitative audit highlighted that over 10% of MMUH patients are prescribed patches. There is 80% compliance with documentation and application guidelines and 90% adherence to documenting the removal of patches (previously not documented at all).

Conclusion: No such guidance exists in any other healthcare facility, either in Ireland or internationally, therefore the requirement for this work went beyond the needs of the MMUH. It was envisaged that by using a multidisciplinary approach these web-based guidelines could be tailored to benefit patients beyond the environs of the MMUH, and therefore would be suitable for national dissemination and implementation.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Reducing the risk of cross contamination with insulin pens in hospital

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Purpose: Using an insulin pen already used for another patient exposes the second patient to any blood-borne pathogens the initial patient may be infected with, e.g. hepatitis B virus (HBV), and/or the human immunodeficiency virus (HIV). Insulin pens that contain more than one dose of insulin are meant for one person use, even when the needle is changed. During injection, blood and biological matter can regurgitate into the insulin cartridge. Many aspects of insulin pen use were undefined in the MMUH leading to inconsistent practices across the hospital. Our aim was to raise awareness for healthcare providers on the safe use of insulin pens and to develop local guidelines to inform safe practice and then audit compliance post implementation.

Methods: A patient-focused group developed Guidelines on the Management of Insulin Pen Devices using best practice points cited in the literature as well as innovative practice-based elements developed locally. Dedicated insulin storage boxes were introduced and storage conditions standardised for each clinical area. A Safe Use of Insulin Pen poster was developed and distributed. Insulin pens from the Pharmacy Department are now individually sealed before distribution to clinical areas.

Results: Web-based guidance has been developed for all healthcare staff. This was augmented by educational posters. A post-implementation audit identified 20 patients using 28 pens on audit day in MMUH. Some patients use more than one insulin pen. There was 86% compliance to labeling procedures for pens and 75% compliance to the new storage guidance conditions.

Conclusion: Web based guidance and One pen, One patient posters have been introduced to educate healthcare staff that insulin pens are for use on a single person only. A follow-up audit highlighted that while the guidelines have had a very positive effect on insulin pen safety, there remains a need to totally eradicate unsafe practice with regard to insulin pen use.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Budget impact analysis of canagliflozin compared to sitagliptin as adjunct oral therapy to metformin in type 2 diabetes mellitus from the perspective of MA Medicaid

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Purpose: In Massachusetts, type 2 diabetes affects approximately 6.8% of the population, resulting in costs over \$6 billion annually. Canagliflozin is a sodium-glucose cotransporter 2 inhibitor recently approved for the treatment of type 2 diabetes. There are numerous agents that can be used as adjunct therapy for patients who cannot achieve glycemic control with metformin monotherapy. The purpose of this budget impact analysis was to compare the safety, efficacy, and associated costs of using canagliflozin versus sitagliptin as adjunct therapy to metformin in patients with type 2 diabetes from the perspective of Massachusetts Medicaid.

Methods: An Excel-based budget impact model was created to compare the annual associated costs of canagliflozin 300 mg daily and sitagliptin 100 mg daily from the perspective of Massachusetts Medicaid. The model accounted for the cost of the medications, the benefits of sustained glycemic control, pleiotropic effects, adverse events, and long term complications. Inputs for the model were derived from various clinical and economic primary and tertiary literature sources collected via a comprehensive literature search on MedLine and Cochrane Library. Data from the Centers for Medicare and Medicaid Services regarding Medicare Part D claims for sitagliptin was applied to the Massachusetts Medicaid population in order to determine the number of eligible patients for the model. Using the budget impact model, economic costs were determined for hypothetical scenarios where Massachusetts Medicaid patients taking sitagliptin were switched to canagliflozin. A sensitivity analysis was performed in order to test the robustness of the data.

Results: A comprehensive literature search revealed data comparing the safety and efficacy of the two medications. Patients treated with canagliflozin had a significantly higher incidence of genital mycotic infections and hypoglycemic events whereas patients treated with sitagliptin had a higher incidence of urinary tract infections. Significantly lower hemoglobin A1c (HbA1c) values were observed in the canagliflozin group. Additional clinical benefits of canagliflozin included significantly greater weight loss and blood pressure reductions than sitagliptin. The budget impact model predicted that if 50 percent of Massachusetts Medicaid patients taking sitagliptin were switched to canagliflozin, there would be an estimated annual savings of

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\$171,000-\$235,000. On average, the cost savings associated with a switch from sitagliptin to canagliflozin was \$29 per claim. The sensitivity analysis demonstrated that the results of the budget impact model were robust.

Conclusion: Canagliflozin has superior efficacy compared to sitagliptin in reducing HbA1c values and achieving glycemic control. Added benefits of canagliflozin include significant weight loss and blood pressure reductions, neither of which is associated with sitagliptin. Canagliflozin can result in cost savings for Massachusetts Medicaid over a 1 year period when used as an alternative to sitagliptin as adjunct therapy to metformin in patients with type 2 diabetes mellitus.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Analysis of the effectiveness and costs of dose optimization of biological drugs in patients with rheumatoid arthritis

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Purpose: Biological therapies (BT) are one of the most important advances in treatment of rheumatoid arthritis (RA) in recent decades. Some studies suggest the possibility of reducing the dose of biological agents with the idea that some patients, perhaps treated too intensively with standard doses, could get the same benefit with a lower dose. This dose reduction practice has been implemented empirically in recent years in the rheumatology practice, partly to achieve cost reductions at a time of economic crisis. The aim of this study is to evaluate efficacy of increased dosing interval (IDI) with etanercept and adalimumab for RA treatment.

Methods: Prospective interventional multicenter study had done in two hospitals for optimize the treatment of RA with BT expanding dosage interval in patients with good response. Treatments of all patients were reviewed by the pharmacist and rheumatologist. The reduced dose regimen was established empirically, on the basis of a suitable control and maintenance of a level of the disease activity, and according to clinical guide in rheumatology (Adalimumab 40 mg/every 3 weeks, Etanercept 50 mg/every 10-14 days or Etanercept 25mg/every week). We analyzed the following variables: current biological treatment (type, dose and duration of biological therapy) and concomitant treatment, and the compound clinical activity index DAS28 at the time of analysis (DAS28<2,4 are considered patients with disease remission). An economic analysis of the intervention was conducted to compare the cost of standard dose and the cost of IDI in the patients studied doses.

Results: A total of 105 patients were analyzed. 57 patients were treated with adalimumab, 25 (14.25%) was extended dosing interval; and 48 treated with Etanercept, the dosing interval was extended to 15 patients (7.2%). Among patients who are extended the interval was available DAS28 values of 32 patients. The average value of DAS28 after extending the dosing interval was 2,050,53. Etanercept treated patients had a mean value of 20,73, and those treated with Adalimumab an average value of 2,080,44. All patients had a disease remission. The annual cost of standard treatment with Adalimumab (40mg/14days) is 14.658,28/patient/year. A total of 25 patients were given a optimization to 40mg/21days, a saving of 122.489/year was obtained. Of these, 16 patients were taking methotrexate with a mean dose of 6,74,6mg/week. Etanercept standard treatment is 50mg/7days, with an annual cost of 13.562,38/patient/year. The dose regimen was extended to 10 days in 2 patients, with a saving of 4.088,01/patient/year, and a dosage extension to 14 days in 8 patients with a saving of 6.799,82/patient/year. With dose

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optimization of 25 mg/week (5 patients) the cost saved was 5.683,32/patient/year. The 15 patients with optimized etanercept saved 62.558,34/year. 6 were taking methotrexate with a mean dose of 6,454,45mg/week.

Conclusion: In our study, based on real clinical practice in two hospitals, we observed that treatment optimization of BT, saved to the national health system 185.047,34 /year maintaining a clinical efficacy of the treatment assessed by DAS28.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Pharmacist intervention pilot project to reduce zolpidem-related inpatient falls

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Purpose: In December 2013 an inpatient fall at our facility occurred that resulted in significant harm to the patient. Our home office Risk and Quality team attributed this fall to the patient receiving zolpidem. The patient was considered to be at high risk of fall and they felt the incident may have been preventable had an intervention been made to stop the patient from receiving this medication. As part of our action plan to prevent this from occurring again, we started a pilot project to stop orders for zolpidem on all high-risk fall patients. The purpose of this study is to determine if this pilot program has reduced zolpidem-related falls at our facility.

Methods: The pilot project began January 1, 2014. All orders for zolpidem received an intervention by the pharmacist. The pharmacist reviewed the Morse fall risk score for each patient and recorded it in the intervention. Any patient with a Morse fall risk score >45 had the zolpidem order rejected and the physician was called and informed of the rejected order. The physician had the opportunity to override the hard stop and if desired provide an alternative medication. To obtain our data for comparison of the pre and post intervention period, we searched for slip and fall related events in our reporting system between Jan 2013 through May 2013 and Jan 2014 through May 2014. A retrospective review of the electronic medical records was performed and the following data was collected: demographics, Morse fall risk scores and medications that the patient received within 24hrs of the fall. The primary outcome variable was tested using an unpaired student t-test. A two-tailed P-value of <0.05 was considered to be statistically significant. All analysis of the data was performed using Microsoft Excel 2010 version. There is not an institutional review board at our facility so approval was not required for this study.

Results: After excluding patients that fell in the emergency room, the mean number of falls per 1000 patient days in 2013 was 1.40 and 1.54 in 2014. There was no statistically significant difference found between the pre and post intervention group (P=0.58). From January to May in 2014 there were a total of 308 orders for zolpidem and 299 interventions documented. There were 87 patients that had an order for zolpidem and were documented as high-risk of fall, 69 of those orders were stopped successfully. In 2013, 10 patients had active orders for zolpidem and in 2014 6 patients had active orders for zolpidem. Only one patient received zolpidem prior to their fall, this was in 2014 and the physician overrode the intervention by the pharmacist. In 2013 ten of the 25 patients that had orders for zolpidem had a Morse fall risk score >45, these orders would have been rejected had the program been in place. Inaccurately calculated Morse fall risk scores were found in 32 of the 54 patients. While evaluating the patients medication profile we

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found that 25 of the 29 patients in 2014 had greater than or equal to 3 medications on their profile that are known to increase the risk of falls.

Conclusion: Stopping zolpidem orders on high fall risk patients was not shown to decrease falls at our facility. Since 86% of patients had at least 3 high-risk medications on their profile it may be beneficial to target that specific patient population when making interventions to prevent patient falls. Because 59% of patients who fell at our facility had inaccurate Morse fall risk scores, re-education of the nursing staff on Morse fall risk score calculations might provide an opportunity to better identify high-risk patients so appropriate interventions may be made to prevent falls. Going forward, daily monitoring should be performed on patients with active orders for zolpidem. Daily monitoring will allow pharmacists to make an intervention to have the order discontinued if the Morse fall risk score exceeds 45.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

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

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Purpose: The demand for post-graduate residency positions available to pharmacy students has continued to exceed the number of available positions. This discrepancy has created increased competition among applicants. Residency programs interview and selection processes have become more formalized and traditional pharmacy education does not prepare students for structured interviews, thus causing anxiety and concern among students. This project was initiated in 2013 to enhance student interviewing skills prior to residency interviews in hopes of increasing the chances of obtaining a residency position.

Methods: A mock residency interview experience was created to provide a simulated interviewing process that could be encountered during residency interviews. Pharmacy Practice faculty and current PGY1 and PGY2 pharmacy residents volunteered to conduct this experience. Fourth year pharmacy students planning to apply to post-graduate residencies were encouraged to participate. Three separate activities which could be expected to occur during a structured residency interview were utilized: 1) one-on-one interview, 2) clinical case evaluation and presentation, and 3) panel interview. The one-on-one interview was with a faculty member posing as a residency director and focused on why students wanted to complete a residency while also encouraging the student to practice asking questions about a particular residency program. The clinical case was to be completed in 20 minutes followed by a verbal case presentation to a faculty member. A panel of three interviewers met with the student and focused on structured behavioral interview questions. Students received feedback after each scenario. Two separate surveys were utilized to assess the students perception of this activity. The first survey was conducted immediately following the exercise while the second survey was conducted after residency interviews and the match process.

Results: Twenty-four students have participated in the mock residency interviews: 11 in 2013 and 13 in 2014. Following the exercise, 100% of students agreed that they felt more comfortable with the types of questions that may be asked during residency interviews. All 24 students stated that they identified areas for improvement in their interviewing skills, they would recommend this experience to future P4 students the following year, and that the constructive feedback provided was helpful. The second survey post-match indicated that 79.1% of these students

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accepted a residency position. One-hundred percent of the students strongly agreed or tended to agree that the mock interviews enhanced their performance during the actual residency interviews. Student feedback regarding areas of improvement after the 2013 interviews involved incorporating more questions from the director perspective and to increase the number of situational questions. In 2013, 91% of students strongly agreed or tended to agree that real residency interview questions were similar to ones asked during the exercise and 9.1% tended to disagree. In 2014, 100% of participants stating that they strongly or tended to agree that the questions were similar.

Conclusion: Providing fourth year doctor of pharmacy students with interview experience via a mock interview proved to be beneficial. The students stated they felt more prepared and confident for the interview component in the residency application process. Also, student feedback from the first year led to an experience that was more similar to actual interviews. Student feedback will continue to be utilized to improve the exercise in the future.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Economic impact of two antimicrobial stewardship initiatives at a tertiary care academic medical center

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Purpose: Antimicrobial Stewardship programs (ASPs) are continuing to evolve in healthcare facilities throughout the United States in order to minimize inappropriate antibiotics and improve patient care in a cost effective manner. Implementation and results of two initiatives at a 454 bed medical center are described. The first initiative was to implement a therapeutic interchange from doripenem to meropenem that would result in cost savings. The second initiative was to decrease the overuse and inappropriate use of linezolid, which had the highest expenditure the previous year compared to all other anti-infectives in our institution.

Methods: Carbapenems: A therapeutic review was conducted to compare safety and efficacy of a therapeutic interchange from doripenem to meropenem. The formulary interchange was approved by the Pharmacy and Therapeutics Committee (P&T) and then implemented. Linezolid: A medication use evaluation (MUE) assessing the appropriate use of linezolid was conducted from October 2012 through January 2013. The MUE revealed 28 percent of the patients were given linezolid inappropriately. Another significant finding was that 70 percent of all linezolid orders and all but one patient with inappropriately prescribed linezolid during this time originated from a single surgical group which allowed for a more specific target for this initiative. A protocol was designed by ASP in conjunction with the surgical group to utilize the pharmacist clinician assigned to the population served by the group to change linezolid to vancomycin in their patients on the surgical nursing floor unless allergies or microbiology cultures dictated otherwise. The pharmacist would also limit the duration of the linezolid in the surgical intensive care unit (SICU) to 72 hours unless clinical evidence prohibited such action. A follow up linezolid MUE was conducted from October 2013 to January 2014 to reassess prescribing.

Results: Carbapenems: The carbapenem interchange was implemented in March 2013. Over one year, there was a 56 percent reduction in purchases of carbapenems as a result of selecting a lower cost agent without compromising safety or efficacy. Implementation of a therapeutic interchange from doripenem to meropenem resulted in a cost savings of \$78,426 over one year. Linezolid: The combined efforts of a pharmacist clinician, data reported from the baseline MUE, and collaboration with a targeted physician group led to more appropriate prescribing. The

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follow-up linezolid MUE revealed a 21 percent reduction in linezolid expenditure from 2012 to 2013, despite a 5 and 24 percent increase in the cost of intravenous and oral formulations, respectively. The surgeons that had been responsible for 70 percent of the linezolid orders in the initial MUE comprised only 47 percent of the orders in the follow-up MUE. The linezolid intervention resulted in not only a cost savings of \$41,697, but also eliminated the number of inappropriately prescribed linezolid orders during the MUE time period. The outcome of both initiatives combined resulted in a cost savings of \$120,123 over one year.

Conclusion: An Antimicrobial Stewardship Programs goal is to promote the judicious use of anti-infectives. As well documented in the literature, these initiatives resulted in a decrease in inappropriate antibiotic use and decreased anti-infective costs. By collaborating directly with those physicians that prescribe these medications most frequently, we were able to make a positive impact on patient care, financial resources and develop relationships that will benefit all stakeholders in the future.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: An evaluation of a clinical pharmacist led medication management program within a patient centered medical home

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Purpose: The patient-centered medical home (PCMH) model of care has demonstrated marked improvements in patient outcomes, reductions in health resource utilization, as well as improvements in patient satisfaction, quality, and clinical outcomes. Studies have described the successful integration of a clinical pharmacist within a PCMH setting, but none have measured the impact of a clinical pharmacist or pharmacy services on resource utilization or medication safety, nor have they directly compared outcomes to a standard of care. The purpose of this study was to evaluate the impact of a clinical pharmacist-led medication management program (MMP) within a PCMH setting.

Methods: We retrospectively identified patients in Sutter Health's electronic health records (EHR) between November 2011 and June 2013, receiving the following: (1) usual-care at a non-PCMH site (usual-care cohort); (2) care at the PCMH site but not the MMP (PCMH cohort); and (3) care at the PCMH site and the MMP (MMP cohort). Patients were eligible for inclusion if they were 18 years of age at the time of their first primary-care visit during the study period, had a follow-up primary-care visit, and had 12 months of EHR activity prior to the first visit. Patients were matched by their propensity score for receiving MMP. Primary outcome measures included rates of health resource utilization. Secondary outcome measures included changes in intermediate clinical outcomes and adverse drug events (ADEs). Because multiple comparisons were performed for each endpoint, a Bonferroni-corrected critical value was used to reduce the chance of a type 1 statistical error ($0.05/3=0.017$). Accordingly, a p-value <0.017 was considered statistically significant for all tests of hypotheses. The Sutter Health Institutional Review Board approved this study.

Results: A total of 281 patients in the MMP were matched to 406 and 421 patients in the PCMH and usual-care cohorts, respectively. MMP patients had a significantly higher incidence of ambulatory-care visits relative to PMCH patients (incident rate ratio [IRR]: 1.19; 95% confidence intervals [CI]: 1.06, 1.33; $P=0.004$) but a lower incidence of hospitalizations (IRR: 0.48; 95% CI: 0.30, 0.78; $P=0.003$). When compared to usual-care patients, MMP patients had similar rates of ambulatory-care visits but significantly lower rates of both hospitalizations (IRR: 0.40; 95% CI: 0.25, 0.63; $P<0.001$) and emergency department visits (IRR: 0.70; 95% CI: 0.53, 0.93; $P=0.014$). No differences in health resource utilization were observed between the PCMH

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and usual-care cohorts. ADEs were rare and were not statistically different between cohorts. Intermediate clinical outcomes, including blood pressure, cholesterol, and hemoglobin A1c control, were also similar between all groups.

Conclusion: Despite an increase in ambulatory-care visits, patients in the clinical pharmacist-led MMP program within a PCMH showed decreased rates of hospitalizations relative to patients in the PCMH alone or those receiving usual-care. A clinical pharmacist embedded within a PCMH may facilitate the management of complex, high-risk patients in an ambulatory-care setting.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Influenza like illness health care visits 2006-2010

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Purpose: 9,632 laboratory-confirmed influenza-associated hospitalizations have occurred in the United States since October 2013. The total economic burden of influenza on the healthcare system, using projected statistical life values, was \$87.1 billion with direct medical costs averaging \$10.4 billion in one study. Early diagnosis and treatment of influenza is crucial. It can lower influenza-related fatalities and decrease medical costs for both the patient and the healthcare system. The purpose of this study is to describe influenza-like illness (ILI) treatment patterns and resource utilization.

Methods: The National Ambulatory Medical Care Survey (NAMCS) and National Hospital Ambulatory Care Survey (NHAMCS) databases from 2006-2010 were used to identify visits for influenza ILI using diagnoses codes and medication records. ILI visits were identified by diagnosis of influenza and treatment with oseltamivir, Tamiflu, zanamivir, and Relenza. Patients that were treated were defined by prescriptions for oseltamivir (Tamiflu), zanamivir (Relenza), amantadine (Symmetrel), and rimantadine (Flumadine) at that visit. Patients with Parkinsons disease or Parkinsonian symptoms were excluded. The screening diagnosis variable was used to determine if the patient received point of care testing. Diagnoses, including the certainty of the diagnosis, service provided at the visit, and medications were analyzed by SAS software. All visits were weighted according to NAMCS/NHAMCS guidance to produce national estimates.

Results: All results were reported on a weighted national average from the years 2006-2010. The total number of ILI visits between 2006-2010 was 19,029,860; 41.05% of those patients were treated with antiviral medications. Of the total number of ILI visits, 71.13% were office visits in which 39.25% of patients were treated; 8.69% were clinic visits in which 42.09% were treated; and 20.18% were emergency department (ED) visits in which 46.91% were treated. The total number of ILI visits with a diagnosis of influenza was 16,355,832, which is 85.94% of the total number of ILI visits. Of those with a diagnosis of influenza, 31.8% were treated for influenza. In 81.47% of visits with influenza diagnosis, the physician was certain of diagnosis. Of those treated, 33.5% were treated without a diagnosis of influenza and 34.9% were treated without being certain of diagnosis. Of those treated without being certain of diagnosis, 69.19% were in an office, 7.68% were in the clinic and 23.13% were in the ED. 9.70% of all ILI visits were seen on the weekend. Of the visits on the weekend, 62.61% took place in the ED (19.10% in clinic and 18.29% in office).

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Conclusion: Many patients are treated for influenza without a definitive or certain diagnosis. Utilization of rapid diagnostic testing (RDT) for influenza may better guide physicians treatment decisions, and in turn decrease resistance to influenza antiviral medications, hospitalizations, and healthcare costs. Additionally, an opportunity exists to reduce ILI ED visits, which may be an inefficient use of resources.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Incorporation of the STOPP Criteria into Clinical Pharmacy Practice

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Purpose: The purpose of this study was to incorporate the Screening Tool of Older Persons Prescriptions (STOPP) criteria into clinical pharmacy practice in the Mater Misericordiae University Hospital (MMUH); to ascertain what proportion of clinical pharmacists' recommendations based on the STOPP criteria were implemented in practice; and to explore doctors reasons for non-implementation.

Methods: Pharmacists applied the entire STOPP criteria to a random selection of inpatients. On identification of a potentially inappropriate medicine(s) (PIM(s)), the pharmacist documented their recommendation(s) in the patients medical records and contacted the patients doctor. Follow up after 3-4 working days determined if the recommendations had been implemented. For recommendations not accepted, a semi-structured telephone interview was conducted with doctors to explore the reason(s) for non-implementation.

Results: - 140 patients were included in the study with a median age of 79 years. The median number of regular medications prescribed was 8. - Pharmacists identified 50 PIMs related to 44 patients; however, on review of the patients medical notes, pharmacists deemed 22 of these PIMs appropriate. - Pharmacists made a written and verbal recommendation involving 28 STOPP PIMs in 25patients (17.8%). - Doctors implemented 16 (57%) out of 28 recommendations, 7 PIMs (25%) were not accepted and 5 PIMs (18%) were lost to follow up. - 7 doctors were contacted to participate in a semi-structured telephone interview in relation to 7 PIMs prescribed (all related to proton pump inhibitors). - The average time taken to apply the STOPP criteria was 9.97 minutes.

Conclusion: Incorporation of the STOPP criteria into clinical pharmacy practice is an effective method of identifying PIMs in the elderly population. Doctors are receptive to clinical pharmacists interventions with the exception of proton pump inhibitors.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Antimicrobial stewardship: a budget impact analysis from the perspective of a small community hospital

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Purpose: Implementation of antimicrobial stewardship programs (ASPs) in university teaching hospitals has slowed the development of antimicrobial resistance while reducing hospital costs and improving patient outcomes. However, the impact of ASPs in small community hospitals, who have smaller budgets and fewer resources to dedicate to ASP activities, has not been as thoroughly investigated. The purpose of this budget impact analysis (BIA) was to examine the impact of ASP implementation on the annual antimicrobial budget of a small community hospital, while accounting for its impact on clinical outcomes, such as hospital length of stay and readmission rates.

Methods: A comprehensive economic and clinical literature search on the implementation of ASPs was conducted on PubMed, Medline, and Cochrane databases. The literature search included the following search words: antimicrobial, antibiotic, stewardship, resistance, cost, economic, Clostridium difficile, clinical, community hospital, teaching hospital, resistance, North America. The search yielded a total of 26 articles, 10 of which were excluded due to having no relation to ASPs, no reported study size, and/or insufficient statistics. Of the 16 remaining articles, inputs from those two by Michael et al. and Malani et al. were utilized for the BIA due to their containing data for the necessary variables of annual hospital admissions, proportion of hospitalized patients presenting with an infection, antimicrobial acquisition cost per patient-day, and hospital length of stay. Estimates of the attributable hospital physician and pharmacist salary costs from ASP implementation and administration were also incorporated in the analysis. These parameters were used to compare the annual antimicrobial budget at a small community hospital with and without an ASP in place.

Results: The BIA demonstrated an overall cost savings of \$69,681 (25% overall reduction) with the implementation of the ASP.

Conclusion: ASP implementation was associated with significant cost savings in a BIA of a small community hospital despite higher physician and pharmacist salary costs.

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Professional Poster Abstract

4-157

Category: Psychotherapy / Neurology

Title: Memantine use in an adolescent with treatment resistant obsessive compulsive disorder and catatonic features

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Case Report

Purpose: Evidence supports glutamate (N-methyl-D-aspartic acid glutamatergic [NMDA] receptor) hyperactivity in the pathophysiology of obsessive compulsive disorder and catatonia. The use of the glutamate antagonist riluzole has demonstrated possible benefits in adults and children with treatment resistant obsessive compulsive disorder in clinical trials. While riluzole appears to be well tolerated, rare reports of pancreatitis raise concerns about its use in the pediatric population. In addition, memantine, an NMDA receptor antagonist, has been reported to be effective for the treatment of catatonia in adult patients who fail to respond to established treatments, including benzodiazepines and electroconvulsive therapy. This case report describes the therapeutic effects of add on memantine in an adolescent with treatment resistant obsessive compulsive disorder and catatonic features. To our knowledge, there is only one case report on the use of memantine to treat adolescent obsessive compulsive disorder and no case reports for the treatment of adolescent catatonia. The patient, a fifteen year old male, immigrated to the United States from South America at age eleven. He had multiple acute inpatient psychiatric hospitalizations beginning at age twelve. According to the patients mother, he had difficulty socializing and engaged in marked ritualistic behaviors since early childhood. He had difficulty with change and transitions and worried about others looking at him, following him, or spitting at him. After his first hospitalization, the patients obsessive compulsive disorder symptoms, paranoia and anxiety initially responded well to a combination of risperidone and fluoxetine. However, pronounced paranoia and obsessive compulsive disorder symptoms recurred despite medication acceptance. The patient was then treated with a combination of olanzapine and sertraline with marked improvement for a short period of time after which symptoms returned again. In June of 2013, at age fourteen, the patient was transferred to a long term care inpatient psychiatric facility. The patient presented with symptoms that included severe obsessive compulsive disorder (compulsions to poke others due to fear of having been touched; compulsions to touch objects due to fear of having been touched by said object), severe and mixed symptoms of psychosis (disorganized and catatonic) and tics (vocal and motor). Despite several trials of combination antipsychotic and anti-obsessive compulsive disorder regimens, the patient continued to experience severe obsessive compulsive disorder and psychotic symptoms. In addition, the patient developed episodes of catatonia that involved episodes of staring,

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posturing, and mutism. Given the treatment resistant nature of the patients obsessive compulsive disorder and the development of catatonic symptoms, the decision was made to add memantine to the patients medication regimen that included risperidone, olanzapine, citalopram, clonidine and lorazepam. Child Yale Brown Obsessive Compulsive Scale, Bush Francis Catatonia Scale and clinical assessment performed before and after the start of memantine indicate clinically significant improvement in frequency and intensity of compulsive behaviors, improved showering, improved conversations with staff (length, content and lucidity) and increased school and group attendance. He is present in the unit milieu more often and spends less time obsessing and performing ritualistic compulsions. This case report supports a possible role for memantine as an augmentation option for adolescents with treatment resistant obsessive compulsive disorder and catatonia.

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Category: Psychotherapy / Neurology

Title: Substance misuse among patients with serious mental illness admitted to an acute inpatient psychiatric unit at an academic medical center

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Purpose: Patients with mental illness have much higher rates of substance use disorders than the general population. Substance misuse is a risk factor for psychiatric medication nonadherence that leads to hospital admission and readmissions for this population, ultimately resulting in poorer clinical outcomes and increased costs. The purpose of this study was to determine the percentage of adults with serious mental illness (SMI) requiring an acute psychiatric hospitalization that have a current or past history of misusing amphetamines, benzodiazepines, and/or opioids and to describe this population as well as compare it to those who do not misuse these particular substances.

Methods: This descriptive study, approved by The University of Arizona Institutional Review Board, was a retrospective chart review of randomly selected patients, ages 18 or older, with a qualifying SMI diagnosis who were admitted to an adult or geriatric acute inpatient psychiatric unit at an academic medical center between July 1, 2011 and June 30, 2012. A qualifying SMI diagnosis for the purposes of this study was defined as having a primary diagnosis from one of the following categories: Psychotic disorders, bipolar disorders, depressive disorders, other mood disorders, anxiety disorders, obsessive compulsive disorder, posttraumatic stress disorder, and personality disorders. Subjects were considered to have a current or past history of substance misuse if any of the following were present: Positive urine toxicology screen with no current prescription or order for a medication in that class, documentation of substance misuse in physician or social worker notes, or a secondary substance use disorder diagnosis at either admission or discharge. Information regarding other misused substances was also collected. A t-test was used to analyze means and standard deviations comparing the two groups (misuse and non-misuse) and a chi-square was used to assess frequencies.

Results: A sample of 849 patient charts was reviewed. The average age of the population was 40.6 years of age (range: 18-97). 55% of the population was male. 60.4% of the population misused at least one substance from the following categories: Amphetamines, benzodiazepines, cannabis, cocaine, and opioids. Cannabis (43.5%) and cocaine (25.5%) were the most common substances misused. Benzodiazepines were least commonly misused with only 6.4% of the population having past or current misuse of this medication class. Amphetamines were misused by 21.9% of the population with methamphetamine being the most common amphetamine misused. Persons with a current or past history of misusing amphetamines tended to be younger (mean age in years=35.1, range: 18-62). Opioids were misused by 17.4% of the population and

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included both heroin as well as prescription opioids. Males were more likely than females to misuse opioids (66.2% vs 33.8%). 56.8% of patients who had misused or had current misuse of opioids had a diagnosis indicating a chronic pain condition (e.g. musculoskeletal, rheumatoid arthritis, fibromyalgia).

Conclusion: This study is the first to specifically describe past and current amphetamine, benzodiazepine, and opioid misuse in patients with SMI who require acute inpatient psychiatric hospitalization in the southwestern region of the United States. Although cannabis and cocaine appear to be the most widely misused substances among this population, misuse of amphetamines, opioids, and to a lesser extent, benzodiazepines, is also occurring. It is critical that interventions be developed to target persons with SMI who have comorbid substance use disorders to reduce the likelihood of hospitalization.

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4-159

Category: Quality Assurance / Medication Safety

Title: Integrating and assessing pharmacists' role in care transitions

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Purpose: Care transitions are often fragmented and a potential source of medication errors. Hospital readmissions may be attributed to breakdowns in care transitions. Potentially preventable 30-day readmissions represent unfavorable health outcomes for patients and are associated with significant financial penalties for hospitals. This multi-modal, multi-disciplinary post-acute care transitions program, employing pharmacists in non-traditional staffing models, was designed to reduce medication errors and readmissions during transitional care.

Methods: A Center for Medicare and Medicaid Innovation grant supports multiple nurses and four pharmacists as members of a post-acute care transition program over a three-year time frame to reduce 30-days readmissions. Teams of nurses and pharmacists are paired with one of six affiliated primary care practices. This team interviews newly admitted patients and provides support for patients for 30-days post-discharge. Pharmacists provide medication reconciliation after admission and prior to patient discharge, patient counseling, medication adherence assessment and strategies to reduce barriers to medication adherence. For select high-risk patients, the pharmacist will provide post-discharge follow-up. A survey was developed and distributed to assess primary care practitioners satisfaction with this service. For a subset of patients, medication discrepancies on pre-admission medication lists and discharge medication lists were measured. The programs impact on readmissions was examined.

Results: Sixty five primary care physicians responded to the survey. Ninety percent of respondent thought the pharmacist provided an overall improvement in medication management and 39% responded that pharmacists identified a medication error. An examination of medication discrepancies for 51 patients revealed that the pharmacists identified a total of 121 discrepancies on the pre-admission medication lists. In comparison, the discharge medication lists for the same subset of patients contained a total of 20 discrepancies. The program also achieved a reduction in 30-day all-cause readmissions over the first 12-months of the three-year demonstration.

Conclusion: Pharmacists are uniquely qualified and trained to serve an important role in care transition programs. Preliminary findings based on analysis of results from surveys to primary care physicians, measuring medication discrepancies on admission and discharge, and assessing impact on 30-days readmission affirm including pharmacists in these programs. However,

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additional exploration is needed to make a financial case in support of pharmacists in post-acute care transition programs.

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Category: Quality Assurance / Medication Safety

Title: Shared electronic clinical record: a useful tool for medication reconciliation in patients with multiple chronic diseases

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Purpose: In May 2012, The European Union Network for Patient Safety and Quality of Care (PaSQ) launched a project with the objective of improving good practices by supporting the implementation of the Council Recommendations. Each participant selected a good practice and then, knowledge and experience were exchanged through the network. In this context, our hospital was focused on medication reconciliation. Using our regional electronic clinical record which provides full access to chronic medication and drug prescriptions at hospital, we designed this study to analyze the frequency and type of medication discrepancies in patients with high comorbidity at hospital admission.

Methods: A prospective, observational study was conducted on a cohort of patients with multiple chronic diseases admitted to a university teaching hospital between January and May 2014. Patients coming from nursing homes (they lacked of electronic clinical record) and those who were admitted to critical care units were excluded. The medication reconciliation process was performed according to the Spanish Society of Hospital Pharmacists guidelines. Data about chronic medication was obtained from the electronic clinical record which is shared among hospitals and primary care units. When it was necessary we recurred to a liaison nurse who interviewed the patient or caregiver to complete the information. Medication discrepancies, type of errors, drug involved and adherence were registered and assessed by two pharmacists. Recommendations were communicated to physicians by phone or through the electronic prescribing program and then, acceptance was evaluated.

Results: Ninety seven patients (57 male and 40 female) were included. The average age was 78 years (48-91). The most frequent diagnosis for admitting were decompensated hearth failure (33%) and exacerbation of chronic obstructive pulmonary disease (12.4%). The patients had 1155 prescribed drugs. We found a total of 552 discrepancies of which 78.2% were intentional, including here undocumented intentional discrepancies. 65 out of 97 patients had one or more medication errors. A total of 120 medication errors were detected with an overall rate of 1.24 per patient. The types of error were: medication omission (47.5%); different route, dose o frequency of administration (43.2%); additional medication (7.6%) and wrong drug (1.7%). Drug classes more frequently involved in errors were: cardiovascular medications, including antihypertensive,

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antiarrhythmic, beta-blocking and vasodilator agents (27.1%), topic ophthalmic therapy (11.0%) and inhaled bronchodilators (9.3%). A total of 114 interventions were made by pharmacists of which 56 resulted in changes of prescriptions. In 6% of the interventions we contacted to family physicians or primary care pharmacists in order to introduce some changes in the patient chronic treatment.

Conclusion: The shared electronic clinical record facilitated the reconciliation medication process in patients with multiple chronic conditions. Pharmacists had an important role in reducing medication errors. Even though, a considerable number of medication errors were detected, so we considered our effort should be directed to train the physicians in the electronic tool and show them all information they can obtain, including patient chronic treatment. Integration of all different assistance levels including nursing homes would be desirable and useful to improve medication reconciliation. We suggest this is a good practice to be implemented by other countries.

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Category: Quality Assurance / Medication Safety

Title: Using performance improvement strategies to reduce medication dispensing errors at an academic hospital

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Purpose: Medication errors are common; some of the errors are preventable. Dispensing is one of the crucial steps in medication management system that can be a source of medication errors. The purpose of this study was to reduce medication dispensing errors by evaluating contributing factors and initiating process improvement at a 609-licensed bed teaching hospital.

Methods: In 2011, the first PDCA (Plan, Do, Check, Act) cycle adopted the Six Sigma DMAIC (Define, Measure, Analyze, Improve, and Control) concept was conducted to reduce medication errors associated with automated dispensing machines. As a result of initial data review, the need for additional safety strategies was identified and barcode scanning was implemented. In 2013, the second PDCA cycle was conducted. Review of data at this time indicated that medication errors were not eliminated, and dialogue began regarding increasing awareness. During October-November 2013 the Pharmacy Safety Forum was utilized as performance improvement intervention. The Pharmacy Safety Forum is an internal monthly meeting for pharmacy associates consisting of pharmacy management, clinical pharmacists, staff pharmacists and technicians. The forum provides the opportunity for open discussion on safety issues and medication errors and encourages brainstorming on improving the medication management system. Staff recommended additional safety check points to occur before medications reached the automated dispensing machines, and recommendations were incorporated into the workflow. To check progress, statistical analysis was used to track monthly dispensing errors, and broken down further into types of pharmacy errors. The data was obtained from the reporting system during the time period of February 2013 to March 2014.

Results: There were a total of 108 medication dispensing occurrences out of 567,251 doses dispensed from February 2013 through March 2014; these errors did not reach patients. The lowest number of occurrences reported during the month of February 2013 with one (1) reported error and the highest number of occurrences reported during the month of April 2013 with sixteen (16) reported errors. The average number of medication dispensing occurrences per month was 7.71. The majority of dispensing occurrences were misfiling medications, orders transcribed incorrectly by pharmacists, incorrect mixing of medications, wrong doses dispensed,

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and wrong medications in automated dispensing machines. The highest dispensing error (37 errors) occurred with misfiling medications, the second highest error (31 errors) occurred with wrong medications loaded in automated dispensing machines, and the third highest error (22 errors) was order transcribed incorrectly; these three types of errors accounted for 83.33% of all medication dispensing errors. After implementation of safety strategies, the average number of medication dispensing errors decreased from 7.80 to 7.50 errors per month, and the average number of incorrect medications in automated dispensing machine decreased from 2.40 to 1.75 errors per month.

Conclusion: The PDCA method allows for continued evaluation and process improvement. During the first PDCA cycle, implementation of the barcode scanning system showed a decrease in medication dispensing errors. The Pharmacy Safety Forum was utilized for the second PDCA cycle as an intervention to further reduce dispensing errors. Pharmacy associates have had a positive feedback on the use of the Pharmacy Safety Forum. It has led to increased awareness of dispensing errors, understanding the types of medication errors that occurred, and emphasis on collaboration in finding strategies to reduce medication errors and improve patient safety.

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Category: Quality Assurance / Medication Safety

Title: Perceptions and practices associated with reporting adverse drug reactions among hospital pharmacists and pharmacy residents from Quebec

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Purpose: The success of drug safety surveillance relies on an efficient pharmacovigilance system. One of the pivot points is spontaneous reporting of adverse drug reactions (ADR) by healthcare professionals to regulatory authority. Hospital pharmacists should play an important role in the detection and reporting of serious, unexpected and unusual ADR. The aim of this study was to evaluate perceptions and practices towards reporting ADR among hospital pharmacists and pharmacy residents.

Methods: A prospective descriptive study was conducted in April 2014 using a survey questionnaire. The initial draft was developed from a literature review. It was pilot-tested by five students and was reviewed by pharmacists. A total of 16 survey items were organized in five sections: demographics, pharmacovigilance training and practices, obstacles to reporting ADR, measures to improve ADR reporting. The web self-administered questionnaire was sent by email to hospital pharmacy directors of hospital with at least 50 acute care beds (n= 63) and pharmacy residents (n=67) in Quebec. Pharmacy directors were invited to respond and relay the email to three pharmacists per hospital (n=252).

Results: A total of 213 respondents completed the survey (response rate 68 percent) with 78 percent of female pharmacists and 46 percent of respondents having 11 years or more of practice experience. Aside undergrad pharmacy curriculum, 21 percent of respondents had completed some pharmacovigilance additional training. On average per year, only 4 respondents were not exposed to serious or unexpected ADR while 46 percent were exposed to 1-4 serious or unexpected ADR and 53 percent were exposed to 5 or more. Only 10 percent of respondents reported 5 or more serious or unexpected ADR to the regulatory authority. While 62 percent of respondents often consulted drug monographs to evaluate ADR, only 42 percent considered the monograph as being a reliable source of information. Respondents also often consulted evidence-based databases such as Micromedex (88 percent) and bibliographic databases such as Pubmed (74 percent). Regarding obstacles to reporting ADR, the most important one was lack of time for 68 percent of the respondents. Finally, regarding measures to improve ADR reporting, respondents see decentralized pharmacists in patient care wards as a key success factor as well as onsite designed pharmacovigilance pharmacy coordinator.

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Conclusion: This study reveals a lack of dedicated training in pharmacovigilance but a willingness of hospital pharmacists to contribute to drug safety surveillance activities. Underreporting remains a critical issue to resolve to improve pharmacovigilance activities. A better understanding of practices and obstacles to reporting ADR can help identify measures to improve ADR reporting.

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Category: Quality Assurance / Medication Safety

Title: Conformity of the drug-use process: a three-year assessment on healthcare units

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Purpose: Canadian pharmacy practice is governed by many standards (e.g. Medication Management Standards from Accreditation Canada, Practice Standards from Provincial Regulatory Authority). In order to ensure continued quality of care and taking into account the current normative obligations, we developed a set of conformity criteria for the drug-use process of healthcare units. The aim of this project was to describe the conformity of healthcare units through an assessment tool over the last three years.

Methods: This is a descriptive and retrospective study. The study was conducted in a 500-bed teaching hospital in Montreal, Quebec, Canada. Following pilot visits on three healthcare units, an assessment tool was developed and pre-tested by pharmacy technicians. The tool relies on a list of 26 criteria covering the following themes: storage, waste, controlled substances, refrigerators, medication carts, automated medication dispensing cabinets, medication reconciliation, documentation, resuscitation carts and pharmacy department Intranet. The conformity of the drug-use process was evaluated through direct observations by pharmacy students and pharmacy research assistants during a two-week round of healthcare units. Levels of conformity per criteria and global conformity were calculated per year. We compared the level of conformity between 2012 and 2014 using Chi-square and Fisher tests, when appropriated. A p value inferior to 0.05 was considered significant.

Results: A total of 26 criteria on healthcare units were assessed in 2012, 2013 and 2014. The global level conformity was of 71 percent in 2012, 65 percent in 2013 and 78 percent in 2014. The situation improved significantly for 5 criteria from 2012 to 2014: presence of a bin for reusable drug returns ($p=0.011$), presence of a waste bin for pharmaceutical waste ($p<0.001$), medication carts cleanliness ($p=0.003$), presence of automated medication dispensing cabinets documentations ($p=0.012$) and presence of patients reanimation pre written order sheet prescription ($p=0.001$). The level of conformity was not reduced for any criteria from 2012 to 2014. The level of conformity remained low for 4 criteria, for example absence of expired drugs (42 percent in 2012 and 35 percent in 2014), continuous monitoring of refrigerators temperature (30 percent in 2012 and 16 percent in 2014).

Conclusion: This study shows a high level of conformity of the drug-use process in a teaching hospital and the usefulness of a periodical evaluation of an assessment tool in unit of care.

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However, there are criteria where significant efforts are required to get higher conformity (e.g. absence of expired drugs, cold chain management). While decentralized pharmacists can contribute to direct patient care, hospital pharmacists should not neglect the whole drug-use process through assessment of the drug-use process.

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4-164

Category: Quality Assurance / Medication Safety

Title: Injectable electrolyte management and conservation in response to ongoing national electrolyte shortages

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Purpose: During the past few years there has been an ongoing national shortage of parenteral electrolytes. Electrolyte shortages have been especially prevalent over the past eighteen months. In an effort to ensure UAB Hospital will continue to have these parenteral formulations available for patients with acute or emergency situations, a culture of conservation needed to be created.

Methods: The first step in this project was development of guidelines for use for phosphate and magnesium. This was projected to be completed by the end of October 2013. Pending approval from the UAB Pharmacy and Therapeutics Committee, education to pharmacists and prescribers concerning the new guidelines for use would be conducted. Additionally, the authors of institutional order sets that were not in agreement with the guidelines for use needed to be contacted and met with to obtain permission to update the order sets and implement the changes. Data was planned to be collected between January 1st, 2014 and March 31st, 2014 to evaluate the adherence to the guidelines for use. An additional comparison of overall usage of parenteral magnesium and phosphate to a three month time period when the hospital was not experiencing a shortage of these parenteral electrolytes would be conducted as well.

Results: Guidelines for use were created and approved by the UAB Hospital Pharmacy and Therapeutics Committee in November 2013. Education was then provided to pharmacists and prescribers. From January 1 to March 31, 2014, there were 2545 patients who met inclusion and exclusion criteria for the analysis of the adherence to guidelines for use. Two-hundred forty-seven patients were randomly selected with 146 patients receiving parenteral magnesium and 101 patients receiving parenteral phosphate. Overall, adherence to the guidelines for use was 73% for prescribing of parenteral magnesium, but only 43% for parenteral phosphate. A subgroup analysis found a higher rate of adherence in the Intensive Care Unit (ICU) compared to the non-ICU setting for both parenteral magnesium (88.7% vs. 61.9%) and parenteral phosphate (57.1% vs. 18.4%). Overall usage of these products comparing current usage to a time period when there were no shortages and before the guidelines for use was also assessed and normalized based on charges per 1000 patient days. An overall decrease in usage of parenteral magnesium of 20.5% and of parenteral phosphate of 25.3% was observed after the implementation of the guidelines for use.

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Conclusion: The implementation of guidelines for use for magnesium and phosphate coincide with a decrease in overall usage of parenteral formulations of magnesium and phosphate. Though there is room for improvement with the adherence to the guidelines for use, adherence is highest in ICUs which have higher rates of usage of these parenteral electrolytes. Limitations are present due to the retrospective nature of this study. The implementation of guidelines for use for magnesium and phosphate has helped create a culture of conservation so that UAB Hospital can try to ensure these products are available for patients in urgent and emergent need.

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Category: Quality Assurance / Medication Safety

Title: System improvement process for pneumococcal vaccination administration

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Purpose: Pneumococcal vaccine assessments are performed on every patient admitted to our facility. However, vaccination rates at our facility remained below acceptable national benchmarks in 2012. A committee was formed to address vaccination failures, propose solutions, and implement change. The committee consisted of pharmacists, quality services staff, and nurse managers. Pharmacists tracked vaccine assessment errors, reviewed the vaccine ordering process, and made recommendations to the committee. A new pneumococcal vaccination process was created and piloted on the acute care floor.

Methods: Nurses on the acute care floor performed a vaccine assessment on all patients admitted to the unit. Once the assessment was complete, an alert was automatically transmitted to a pharmacist via the electronic medical record who would then enter a one-time order for a pneumococcal vaccine for qualifying patients. Vaccines were stocked on the unit so they were readily available for immediate vaccination. Additionally, a unit based clinical pharmacist would review each patient daily and would identify high risk patients requiring pneumococcal vaccination that were previously overlooked by nursing. These patients were re-assessed and offered the vaccine. Alerts were sent to nurses who had made vaccine assessment errors in an effort to reduce repeated errors. Patients qualifying for vaccines that hadn't been vaccinated within 24 hours of admission were identified in a daily quality huddle and were re-addressed. Also, the clinical pharmacist for the unit regularly gave training to the nurses on the floor on proper pneumococcal vaccine assessments in nursing staff meetings and new hire orientation trainings.

Results: The new process was piloted on a 35 bed acute care floor from April 2013 until December 2013. Pharmacist review of pneumococcal vaccine assessments identified 45 patients eligible for the vaccine that nursing previously assessed as non-eligible. The vaccine was then offered to these patients and 22 patients accepted vaccination. The most common high risk criteria overlooked by nursing were: lung disease/asthma, smoking, diabetes, and liver disease. Pharmacist intervention also prevented 10 patients who were not eligible for the vaccine from receiving it. The acute care floor rate of pneumococcal compliance in 2012 was 92%. The compliance rate increased to 100% during the pilot period.

Conclusion: Pneumococcal vaccination rates dramatically improved with pharmacist participation in the vaccine screening process on the acute care floor. Alerting nurses when assessment mistakes were made helped reduce future assessment errors and under-vaccination at

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the facility. Daily huddles reinforced nursing accountability and resulted in increased understanding of the importance of vaccination. This process could be implemented on other units and at other facilities as a means to improve vaccination compliance.

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4-166

Category: Quality Assurance / Medication Safety

Title: Systematic assessment of Alabama nursing homes medication-use processes

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Purpose: Little published research is available that evaluates the medication-use process (MUP) (i.e., prescribing, transcribing, dispensing, administration and monitoring of medicines) in long-term care facilities (LTCFs). The Centers for Medicare and Medicaid Services (CMS) acknowledges that standards for oversight and enforcement of the MUP in LTCFs is lacking. A safe medication practices workbook was located from the Massachusetts Coalition for the Prevention of Medical Errors (MassPro) website and modified into a data collection tool for pharmacy-specific outcomes. The purpose of the project was to identify areas to improve the MUP of the LTCFs, through the use of a data collection tool.

Methods: Medication-related practices were assessed in a sample of Alabama LTCFs (n equals 23) affiliated with Alabama Alliance for Nursing Facility Quality and Care Coordination [Initiative to Reduce Avoidable Hospitalizations among Nursing Facility Residents], a grant project through the CMS Innovations Center. All LTCFs agreed to participate in the 4-year grant initiative and gave permission for data collection. The tool was pilot tested by one faculty member in one LTCF and two Registered Nurse coaches (i.e., Care Pathways Coach) to assess for content clarity and feedback. After pilot-phase modifications were made, the tool was developed into an Adobe PDF file for online access and data input. The tool was completed by the care pathways coach prior to faculty visits. Faculty from Samford University McWhorter School of Pharmacy Drug Information Service visited LTCFs to determine MUPs via the data collection tool. Completion of the tool included review of existing policies and procedures and a discussion with the care pathways coach and other nursing facility administrators. Quantitative and qualitative data were collected and compiled into a Microsoft Excel spreadsheet. Non-numeric qualitative variables (i.e., free-text) were analyzed manually to determine similarities and differences between LTCFs. The university IRB approved this project.

Results: Over the course of three months faculty members traveled to all LTCFs enrolled in the grant to complete the data collection tool, which was the centerpiece of the site visit. After the visit, each LTCF received an individualized assessment letter benchmarking their LTCFs MUP compared to the LTCF grant cohort. Specific recommendations for each home were developed to provide start-up initiatives for medication safety teams which were to be formed in a subsequent phase of the grant. Common recommendations included providing listings for look alike, sound alike medications and high-alert medications in highly visible areas; providing training for nurses to conduct monthly edits; developing policy/procedures for crushing medications and

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coadministration of medications with food; and providing laboratory indices for narrow therapeutic drugs on patient medication administration records. Several other goals for medication safety teams were established including implementation of a just culture, developing reporting systems for adverse events, and educating and assessing staff retention of medication errors and adverse drug reaction identification and reporting.

Conclusion: The data collection tool was beneficial in identifying areas of improvement in each facility's MUP. Specific recommendations were provided to each LTCF to be implemented by the LTCF's medication safety teams. These interventions will be instrumental in helping to improve the quality of care in LTCF residents.

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4-167

Category: Quality Assurance / Medication Safety

Title: Pharmacist role for achieving compliance with discontinuation of antibiotics within 24 hours of surgery end time and reduction in clostridium difficile rates

Primary Author: Hillary Guadagno; Email: hguadagno@adirondackhealth.org

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Purpose: Attaining compliance with Surgical Care Improvement Project (SCIP) measures reduces surgical complications and improves institutional benchmarks. A measure for stopping antibiotics within 24 hours of surgery end time (SCIP-INF-3) was identified as a benchmark that needed improvement. This project was designed to utilize pharmacy staff as part of a multidisciplinary team to improve compliance with this measure and subsequently reduce surgical complications associated with antibiotic overuse. Clostridium difficile infections were identified as complications that needed improvement. This was a timely goal as the Center for Disease Control and Prevention (CDC) classified Clostridium difficile as an urgent level organism.

Methods: A pharmacist with antimicrobial stewardship experience was involved with a multidisciplinary team in developing computerized physician order entry (CPOE) order sets embedded with clinical evidence for postoperative hip and knee replacements. The order sets included a defaulted order for cefazolin administered every 8 hours for 2 doses. The staff pharmacists were given access to identify the start of the operative procedure. Pharmacists were trained to ensure the last dose of antibiotics fell within 24 hours of the start of the operative procedure. Pharmacists were encouraged to contact providers when the timing of the last dose was outside the 24 hour window. Pharmacy staff worked in conjunction with a Clinical Documentation Coordinator. The Clinical Documentation Coordinator served as a final check in the process and identified any potential fallouts. The ordering providers were then contacted for appropriate documentation of the indication for continued use of the antibiotic. The pharmacist project leader presented antimicrobial stewardship concepts to the community, emergency room staff, infection control committee, and health center providers. The concepts included appropriate drug, dose and duration. The presentation also focused on the new CDC hazard level classifications for urgent level organisms including Clostridium difficile.

Results: The institution achieved 100% compliance with SCIP-INF-3 one quarter post the implementation of pharmacy involvement. The Clostridium difficile rate fell below the New York State Department of Health compliance target within the same quarter of achieving 100% compliance on SCIP-INF-3. The institution recognized the success of the project via awarding a poster presentation with the Gold Medal Peak of Excellence Award. The hospital was recognized for the greatest improvement in the combined clinical process and surgical care improvement project measures at the Excellus Hospital Performance Incentive Program Quality Forum.

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Conclusion: Pharmacists are vital team members in achieving compliance with SCIP measures and reducing antibiotic overuse complications such as Clostridium difficile infections. Pharmacists can ensure appropriate timing of postoperative antibiotics, communicate with ordering providers and educate the community and staff on antimicrobial stewardship.

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4-168

Category: Quality Assurance / Medication Safety

Title: Development and implementation of a USP 795 nonsterile compounding training program

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Purpose: USP 795 became an official chapter in 2011 and the Alabama Board of Pharmacy began to uphold this standard in 2012. USP 795 explains good compounding practices and general nonsterile compounding information. The purpose of this project was to design a training program to educate selected pharmacy staff on USP 795 and to correct deficits revealed through the gap analysis.

Methods: A gap analysis was performed to determine deficits in the knowledge of nonsterile compounding. A training program was developed to teach selected pharmacy staff and orient them to the institutions policies and procedures regarding this USP chapter. The pharmacists and technicians trained were those who perform nonsterile compounding in their respective areas of practice. The training program concentrates on the major topics within the USP 795 chapter, the deficits from the gap analysis, and the goals from the institutions competency form. A pretest and posttest were administered to test the efficacy of the training program. A competency form was used to document training in nonsterile compounding.

Results: Sixty nine participants were included in the IRB approved study. The average pretest score was 10.8 out of 20 (54 percent). Fifteen training classes were taught. The average posttest score was 18.1 out of 20 (90.5 percent). The average change of score was an increase of 7.3 (36.5 percent). All sixty nine participants were validated through the institutions competency form.

Conclusion: The training program proved successful in educating the selected pharmacy staff on USP 795 rules and regulations. Subsequent new hires in areas performing nonsterile compounding will be required to participate in the training program. A practical during the training program will be required moving forward. The test created for this project will need to be completed with a passing grade to finalize the competency validation form for the new hires.

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4-169

Category: Quality Assurance / Medication Safety

Title: Borrowing safety strategies from aviation: the development of a simulation lab to assess compounded sterile product preparation by pharmacy technicians

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Purpose: Across the country, healthcare systems have adopted safety measures similar to those used in the aviation industry such as standardization of procedures, checklists and standardized training. Borrowing strategies from aviation, we wanted to standardize compounded sterile product (CSP) preparation and create a simulation lab that could be used to observe technician practice to identify deviations from standardized compounding procedures.

Methods: The medication safety coordinator, sterile processing lead and pharmacy resident developed a simulation lab to assess pharmacy technician skills and technique when preparing CSPs. Standardized procedures were established and an observation tool was created that would be used as part of a simulation lab to assess gaps in standardization of practice. The simulation lab incorporated an interactive discussion with the pharmacy technician, highlighting how valuable their role is to the medication use process, outlined the goals and expectations of the assessment, and incorporated a medication misadventure story for discussion and reflection. The tasks the technicians were asked to perform during the observed simulation portion were intended to mimic their day-to-day activities. The simulation lab was conducted by the medication safety coordinator, the sterile products lead and the pharmacy resident over a 3 month period.

Results: Twenty-five pharmacy technicians participated in the CSP simulation lab. The mean number of deviations from the defined standard of practice was 9.7 (Max 18, Min 0, and Median 10). Technician response to the simulation lab was overall positive, noting they expressed an increased awareness of the importance of their job as a result of this experience. Those employees with greater deviations from standard practice were immediately removed from the clean room and remediated.

Conclusion: As part of our next steps we will identify opportunities to improve standardized workflow in the clean room, which includes utilization of a cleanroom automation program and re-education of staff, including pharmacists. We intend to utilize this simulation tool at a future point to evaluate the impact of these interventions, with the goal of reducing our deviations from

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standard practice to zero. We also anticipate using this tool as part of clean room training validation for new employees.

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4-170

Category: Quality Assurance / Medication Safety

Title: Continued use of the insulin pump in the inpatient setting: a review of safety and efficacy

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Purpose: Insulin pumps have revolutionized the treatment of type 1 diabetes. Use of the pump has been steadily increasing due to its superior efficacy and safety. Patient education is intense and besides their endocrinologist, patients are the most knowledgeable about pump utilization. When insulin pump patients are admitted to the hospital, potential exists for mismanagement of the pump due to lack of familiarity on the part of health care professionals as well potential cognitive changes in the patient. The purpose of this study was to review the safety and efficacy of continuing to use the insulin pump in the inpatient setting.

Methods: The institutional review board approved this retrospective chart review of patients admitted and continued on an insulin pump between July 2012 and June 2013. The same patient admitted more than once during the study period was included in the analysis. Patients were excluded if they were admitted to the intensive care or behavioral health units and if they were admitted in DKA. Data was collected on patient demographics (age, sex, type of diabetes, type of insulin in pump and most recent hemoglobin A1C). Other data was collected on time elapsed between admission date and pump order entry date, endocrinology consult and cognitive assessment. Safety and efficacy was assessed by evaluating blood glucose data. Hypoglycemia was defined as blood glucose less than 70 mg/dL and severe hypoglycemia was defined as less than 40 mg/dL. Hyperglycemia was categorized into glucose values 200-299, 300-399 and greater than 400 mg/dL, respectively. These blood glucose values were also compared to non-pump patients hospitalized during the study period. Other safety measures evaluated included reasons for pump interruptions and concomitant subcutaneous insulin administration (whether purposeful or accidental).

Results: A total of 86 patients were included in the analysis. The average age was 54 years and 62 percent of patients were female. Eighty percent of patients had type 1 diabetes and the great majority of patients (93 percent) utilized a rapid-acting insulin analog in their pump. Interestingly, 70 percent of patients presented with a hemoglobin A1C greater than 7 percent and 19 percent of patients were greater than 9 percent. Eighty one percent of patients had an endocrinology consult. Regular cognitive assessment was documented on 83 percent of patients. Seventy five percent of patients had an insulin pump order entered within 2 days of hospital admission. Evaluation of blood glucose data revealed that 92 percent of patients experienced at least one episode of hyperglycemia and 27 percent experienced at least one episode of hypoglycemia. Rates of hypoglycemia were very similar between pump patients (2.3 percent) versus non-pump patients (2.7 percent). Interestingly, hyperglycemia rates were higher in pump

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patients at 38.3 percent versus 26.8 percent in non-pump patients. Pumps were interrupted on 20 percent of patients, with the most common reasons for interruption being acute cognitive change and procedure/testing. Finally, 8 percent of patients received concomitant subcutaneous insulin therapy.

Conclusion: Opportunity exists for improvement in the safety and efficacy of the insulin pump in the inpatient setting. All patients should have an endocrinology consult. An order set should be developed to optimize nursing assessment due to the infrequency of insulin pump admissions. Routine education should be provided to health care professionals. Although blood glucose control on the insulin pump was not better than non-pump patients, the authors recommend insulin pumps be continued in the inpatient setting if the patient is able to operate the pump and is willing to work with the endocrinologist to make changes secondary to acute illness.

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4-171

Category: Quality Assurance / Medication Safety

Title: Pharmacy-led cleaning certification program engaging non-pharmacy personnel improves sterile compounding environmental quality assurance

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Purpose: Pharmacy staff partnered with representatives from the hospitals cleaning service to pilot procedures, training, and tools to impact environmental microbial quality assurance trends. USP <797> sets the standard for environmental quality assurance of sterile compounding facilities by specifying a baseline of cleaning requirements for engineering controls. This collaborative effort aimed to surpass these standards and create practical tools for non-pharmacy personnel to sustain quality assurance best practices in secondary engineering controls.

Methods: Frontline environmental services and pharmacy representatives identified 27 enhancements throughout the cleaning process to improve the consistency of best practices and quality assurance outcomes. The interventions addressed preparation for cleaning, garbing, cleaning secondary engineering controls, and post cleaning. Examples of interventions include closing hoods during cleaning, vacuuming vents, rotating cleaning agents, posting signage on the sequence of cleaning, relocating designated supplies closer to the work area, and enhancing the cleaning process for floors. For the pilot, two environmental services staff members routinely cleaning the pharmacy were identified to participate in the training. Training content covered USP <797> requirements, systems engineering safety principles, and pilot protocols and tools. An observational competency assessment of 31 criteria was used to evaluate training effectiveness. Prior to the training, baseline observations were performed using the competency tool. After the interventions and training, an easily cleanable pictorial protocol reference or observational method sheet (OMS) was posted in the clean room and ante room. The reference detailed the cleaning protocol specific to each surface and was conveniently available at the location of cleaning. Consistency with the observational competency tool criteria was evaluated after the interventions and training. Quality assurance outcomes were measured by environmental sampling results.

Results: Three competency observations prior and three observations after the training were performed with at least one observation per person for the two individuals trained. Of the competency criteria, 52% (N=35/67) prior to implementation and 94% (N=64/68) after implementation were met. Improvement or attainment occurred for all criteria evaluated. Improved adoption was observed for new procedures such as alternating cleaning agents, closing

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hoods during cleaning, special floor cleaning, posting notice of the duration of restricted entry, cleaning equipment, and increasing monthly cleaning to twice a month. Other notable improvements were observed for appropriate attire, hand hygiene and garbing, and cleaning order from ceiling to floor. Of the environmental samples collected prior to the interventions, 28% (N=10/36) required follow up; however after the interventions and certification process only 11% of samples (N=7/65) required follow up ($p=0.0287$, OR 0.31). During the five months prior to the interventions, two samples in primary engineering controls required additional actions, but for 12 months after implementation there were no samples in primary engineering controls which required follow up. Less follow up was required in secondary engineering controls post implementation. Other pharmacies serviced by the certified staff members also reported improvement in secondary engineering control quality assurance results.

Conclusion: The pharmacy-led interventions and certification pilot facilitated improvements observed in pharmacy environmental monitoring trends. Based on the observational competency assessment, skills required were understood and incorporated into workflow by non-pharmacy personnel. The certification program transferred benefits to other pharmacies where the trained staff cleaned as well. Improved outcomes can also be attributed to improvements made in facilities during this time but cannot fully account for the improvement across the secondary engineering controls as the facilities adjustments affected only one room. This effort will lead to subsequent development and assessment of cleaning standards for the general pharmacy area.

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Category: Quality Assurance / Medication Safety

Title: Biosimilars: Will your health-system be ready? A medication safety officer perspective.

Primary Author: Steven Jarrett; Email: steven.jarrett@carolinashealthcare.org

Purpose: In 2012, an estimated 160 billion dollars were spent on biologic agents worldwide. Biosimilar agents, currently marketed in Europe, are biological drugs that are highly similar to marketed biological drugs apart from minor differences in clinically inactive components. According to the FDA, there are no clinically meaningful differences between the biosimilar drug and the already marketed drug in terms of the safety, purity, and potency of the product. The Affordable Care Act of 2010 provides an abbreviated licensure pathway for biosimilar drugs. Because biosimilars are not just generic drugs, specific processes must be developed to ensure that their introduction to the formulary is associated with safe, high quality patient care. In the near future some biologic agents will lose patent exclusivity in the United States, making way for biosimilar agents. The purpose of this report is to describe actions and considerations for preparing a large multi-hospital, health-system in anticipation of biosimilar agents arriving into the US marketplace.

Methods: Since biosimilar agents are not like traditional generic drugs, an internal educational program was implemented for the pharmacy, nursing and medical staffs as well as hospital administration. This consisted of educational materials and medical literature that described the manufacturing process, approval process safety (immunogenicity), anticipated postauthorization pharmacovigilance efforts, and switching considerations. / Formal discussions and training with health care professionals (i.e., MDs, RNs, pharmacists) within the healthcare system were conducted to ascertain baseline knowledge and uncover issues that the professional staff deemed important to patient care and safety. Additionally, an analysis was conducted of potential areas within the health-system that may be impacted by the approval and introduction of biosimilar agents to the US medical community. /

Results: Staff gained an appreciation for the difference between biosimilars and generics. Areas within the health-system that will most likely be impacted include hospital inpatient, ambulatory and infusion centers, specialty pharmacies, and our self-administered health-system insurance plans. / Discussions and research indicated that the HCPs needed more education. Topics include: 1) the approval pathway of the agent 2) indications included in the FDA approval 3) available information for use in off label situations and/or for special populations 4) interchangeability or therapeutic substitution 5) consideration for patients who present on certain agents in the different areas of care which product will be used and how patients can safely move through the system 6) monitoring of adverse effects specific to the individual biologic entities and post approval surveillance and 7) impact to order sets, shared baselines, and protocols. /

Conclusion: The first biosimilar agents are forecast to reach the US market in 2015. It is clear that health-systems will be impacted in many ways by the introduction of these products.

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Education of health care professionals within the institution is a critical success factor. Pharmacists need to take the lead in preparation of a non-traditional approach to formulary review with the biosimilars. Safe and effective patient care is dependent on the ability to apply a standard approach across the continuum of care. Interchangeability assessments (therapeutic substitution), a system for pharmacovigilance, staff education, and support for patients during transition are the pillars of a successful approach for preparing for the coming biosimilar agents.

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Category: Quality Assurance / Medication Safety

Title: Time counts in a 1,000 bed hospital - STAT medication availability improvements: Reallocating, communicating & connecting within the hospital network.

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Purpose: Outcomes of acute medical conditions or disease states can often be directly affected by the timeliness of the first dose. Within our institution, approximately 75% of STAT-ordered medications are currently available in Automated Dispensing Machines (ADMs). As part of an ongoing project to improve the time to STAT medication access & improve patient care, our Pharmacy Quality, Safety, Education, & Compliance (QSEC) department aimed to maximize ADM-availability of medications frequently ordered STAT for acute medical conditions & to streamline communication methods within the hospital network. To complement this initiative, an educational competency assessment module was developed to enhance pharmacist and pharmacy technician understanding of acute conditions requiring expedited administration of first dose.

Methods: As part of a comprehensive assessment, Pharmacy QSEC compiled a list of medications frequently ordered STAT for acute conditions based on provider order entry (POE) & ADM medication-override data sources as well as input from clinical pharmacists & customer service pharmacy technicians. Identified medications that were available in ready-to-use form, including vials & minibags to be assembled by nursing, were added to ADMs on patient care units and monitored for par level adjustments as needed. Standardized communication methods were featured in a medication availability policy in response to front-line practitioner feedback and safety reports that had shown that many practitioners were unaware of the most efficient methods to expedite medication access. The educational competency module featured the new policy including the communication methods, and acute medical conditions & was given to all inpatient pharmacy staff, requiring a 100% score to pass. The frequency with which the medications added to the ADMs had been ordered STAT or routinely in the month prior to the reallocation was tabulated & utilized to calculate average time gained by the patient caregiver by having the identified medications newly available in the ADMs. The number of medications added to ADMs was also tracked.

Results: Thirteen medications were identified as fitting the criteria of this project, for the medical conditions including hemo-dynamic instability, pain/emesis/seizures, acute psychosis, &

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serious infections. Eighty-five medications in total needed to be added to ADMs on select patient care units. In the month prior to the addition of medications to the ADMs, 67 STAT-ordered & 202 routine-ordered doses had been prepared & dispensed by the pharmacy. Adding these specific medications to the ADMs provided up to 67 hours/month or approximately 2 hours per day of time gained by the caregiver compared to awaiting the dose from pharmacy when ordered STAT. Similarly, up to 404 hours/month or approximately 13.5 hours/day were gained when routinely ordered. Alternatively, 269 (67 STAT & 202 routine) doses that have been added to the ADMs would be available to the caregiver and patient within 15 minutes of notification to the pharmacist with patient profiling in place. ADM par levels required only minor adjustments. Feedback by front-line pharmacy staff and by members of multidisciplinary quality/safety committees felt these process improvements had made significant impacts on improving access to first dose of STAT ordered medications overall as well as improving connectivity & communication among caregivers with the shared aim to deliver quality care to our patients.

Conclusion: 'Reallocate, communicate, connect': These process improvement changes within our institution have resulted in immediate gains with positive impacts to our patients with a new appreciation and connectivity amongst our providers. Continued quality oversight will be performed to support the sustainability of this new, multi-faceted model for expediting STAT medications.

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Category: Quality Assurance / Medication Safety

Title: Patient-specific intermediate- and long-acting insulin doses: transitioning from a nursing- to a pharmacy-dispensed process

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Purpose: Insulin subcutaneous and intravenous are considered high alert medications at an academic teaching hospital. Additionally, they are classified as look-alike/sound-alike medications. Currently, all subcutaneous insulin products are stored on nursing units at room temperature in automated dispensing cabinets (ADCs). Nurses draw up patient-specific doses prior to administration. Unused medications are wasted after 28 days. The Joint Commissions Medication Management Standard recommends that medications be dispensed in the most ready-to-administer forms commercially available, and if feasible, in unit doses that have been repackaged by the pharmacy. The purpose of this project was to implement a pharmacy-dispensed patient-specific program for intermediate- and long-acting insulins.

Methods: A one-month data collection on insulins wasted from the ADCs was performed. Results from a prior University HealthSystem Consortium (UHC) survey were utilized to determine if other hospitals have implemented a pharmacy-dispensed insulin program. A working group was developed to design and implement the new pharmacy-dispensed insulin process. Education was provided for pharmacy and nursing staff. Insulin purchase data was compared pre- and post-implementation to determine any cost-savings. Additionally, reported insulin medication errors were analyzed for changes possibly impacted by the process change.

Results: One-month data collection on insulins wasted by the pharmacy showed an annual cost-saving opportunity of approximately \$30,000. Twelve hospitals responded to a UHC query from September 2013. Of those, eight were dispensing patient-specific insulin glargine doses from the pharmacy. Four hospitals were currently not dispensing from the pharmacy with two hospitals in the process of evaluating the workflow change. Education materials were developed for the pharmacy staff including a technician training checklist and signoff document. Additional in-service was provided to staff responsible for batching the insulin syringes three times a day. Subcutaneous insulin products dispensed by pharmacy included insulins glargine, detemir, NPH and lispro mix 75/25. Reported insulin medication errors did not differ significantly before and after implementation of the process change. Wrong dose remains the most common error type. Preliminary results at 6 months post implementation indicate approximately \$78,000 annual savings. Annual insulin purchases have been decreased by 53%.

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Conclusion: Converting all patient-specific intermediate- and long-acting insulin doses to a pharmacy-dispensed medication was both challenging and rewarding. On average, the pharmacy department prepares 60 syringes daily. Storing subcutaneous insulin in the central pharmacy versus ADCs on numerous nursing units resulted in a significant decrease in inventory, waste, and annual drug spend.

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Category: Quality Assurance / Medication Safety

Title: Initial implementation and ongoing development of a computerized provider order entry-based alerting system advising appropriate drug dosage for patients with renal insufficiency

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Purpose: To improve the appropriate dosage of prescriptions among patients with renal insufficiency, a computerized provider order entry (CPOE)-based alerting system was implemented in a hospital for inpatients in May 2012 and outpatients in May 2013.

Methods: An alerting system for appropriate renal dose adjustment replaced the manual surveillance by pharmacists. A pop-up alert will appear to list the recommended dosage based on renal function when inappropriate dosage of a new medication was prescribed. Clinicians will be asked to choose a reason of rejecting the recommended dose adjustment. In addition, the reasons not accepting the dose adjustment recommendation were analyzed to improve the quality and performance of the system. The total rates of accepted intervention will be compared before and after performing the quality improvement strategies.

Results: Among inpatients with renal insufficiency, it alerted 930 more inappropriate prescriptions than manual surveillance by pharmacists and the acceptance rate for dose adjustment recommendations also increased from 32% to 43% for one month after inauguration of the computerized system. The total suggestions of the alerting system were 17,498 among inpatients from May 2012 to April 2014 and 13,492 among outpatients from May 2013 to April 2014. The total rates of accepted intervention increased from 43 % to 71 % among inpatients and 30% to 56% among outpatients after performing quality improvement strategies.

Conclusion: The alert system provides clinicians a real-time renal dose adjustment suggestion and improves the medication safety of patients with renal insufficiency. Due to the increased total rates of accepted intervention, quality improvement strategies were performed periodically.

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Category: Small and Rural Pharmacy Practice

Title: Does vancomycin or piperacillin/tazobactam have the greater potential for acute kidney injury?

Primary Author: Mary Jo Garst; Email: mgarst@gcrmc.org

Purpose: Reports in the literature have indicated that vancomycin and piperacillin/tazobactam (pip/tazo) are both capable of causing acute kidney injury (AKI). In several studies pip/tazo has demonstrated more nephrotoxicity than vancomycin. Simultaneous administration of vancomycin and pip/tazo has been shown to have an even greater potential for kidney injury than when either of the antibiotics are administered as a single agent. Dose adjustments in our renal dose monitoring program have suggested more AKI with vancomycin than with pip/tazo. A study was undertaken to determine the extent of AKI from vancomycin and/or pip/tazo administration in our community hospital.

Methods: Data was collected in a retrospective chart review of all inpatients over 18 who received vancomycin, pip/tazo or concomitant administration between May 1, 2012 to April 30, 2014. Acute kidney injury (AKI) was defined as an increase of greater than or equal to 0.3 mg/dL or a 1.5 fold increase in serum creatinine from baseline at any time during the antibiotic therapy. The patient had to receive the antibiotic(s) for at least 48 hours. Any comorbidities or nephrotoxic agents that could contribute to a rise in serum creatinine were noted for patients showing AKI. Factors that can contribute to AKI include: 1) history of renal insufficiency and other co-morbidities, 2) hemodynamic instability i.e., sepsis/septic shock, trauma or major surgery, 3) elderly, dehydration, 4) co-administration of nephrotoxic drugs. A total of 631 charts were reviewed.

Results: Published studies described patient populations and results. Hellwig, et al, studied 735 hospitalized patients. Vancomycin had an AKI rate of 4.9 percent, pip/tazo had an AKI rate of 11.1 percent and vancomycin and pip/tazo had an AKI rate of 18.6 percent. Min, et al, studied 140 surgical intensive care patients. Vancomycin had an AKI rate of 9 percent. Pip/tazo administered as a single agent wasnt studied. Vancomycin and pip/tazo had an AKI rate of 40.5 percent. NorthBay studied 228 hospitalized patients. Vancomycin AKI rate was 1.6 percent. Pip/tazo had an AKI rate of 2.2 percent. Vancomycin and pip/tazo had an AKI rate of 19.3 percent. From May 1, 2012 to April 30, 2014, 631 inpatient charts were reviewed. Two hundred two patients received pip/tazo with nineteen patients experiencing AKI (9.4 percent). One hundred fifty-three patients received vancomycin and nineteen patients experienced AKI (12.4 percent). Two hundred seventy-six patients received both pip/tazo and vancomycin. Fifty-eight patients experienced AKI (21 percent). In contrast to other published results vancomycin caused more AKI in our facility than pip/tazo when administered as single agents Our study verified the increased potential for AKI when vancomycin and pip/tazo were administered concurrently.

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Conclusion: Our data corroborates findings of a significant potential for AKI when vancomycin and pip/tazo are administered concurrently emphasizing the need for conscientious renal dose monitoring in patients receiving both antibiotics. In contrast to literature reports, however, our study observed a greater potential for AKI attributed to vancomycin rather than pip/tazo when administered as single agents. Renal dose monitoring can assure appropriate antibiotic dosing, identify at-risk patients and adjust doses at the first sign of kidney injury. Pharmacy to dose allows expedient pharmacy response when there is a marked increase in serum creatinine or trough levels exceed guidelines.

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Category: Small and Rural Pharmacy Practice

Title: The use of a rural community hospital to model the implementation of antimicrobial stewardship programs across the state of Hawaii

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Purpose: In recent years the emergence of multidrug resistant organisms (MDROs) have increased in prevalence. These organisms are associated with an increased mortality risk, prolonged hospitalization, and increased hospital costs. To prevent the development of MDROs, and promote appropriate antimicrobial use, The Joint Commission, the Centers for Disease Control and Prevention (CDC), and The Infectious Diseases Society of America (ISDA) endorse the implementation of ASPs in all hospital institutions. The purpose of this initiative was to design an antimicrobial stewardship program (ASP) that can be used to justify and expand ASPs across the state of Hawaii.

Methods: Retrospective data collection utilizing Premier, an electronic database, was performed for patients admitted to with a primary or secondary diagnosis of pneumonia and/or cellulitis between January to April 2012, and January to April 2013. The same time periods were chosen for each year to account for seasonal variability, such as influenza. Pneumonia and cellulitis were chosen as inclusion criteria for patients since these are some of the most common infectious diseases in which patients are admitted for at WMH. To assess the ASPs impact on patient centered outcomes, primary outcome measures included length of hospitalization, total antimicrobial use, 30-day readmissions, and mortality. A secondary measure of costs savings were calculated based on estimated doses for antimicrobial orders and cost of drug acquisition. Observational chart reviews utilizing EPIC, an electronic medical record, were performed to assess mortality, and CURB-65 scores. For each of these outcome measures, statistical significance was calculated using the Students T-test for length of hospitalization, total antimicrobial use, IV antimicrobial use, and PO antimicrobial use. The Chi-Squared test will be utilized for 30-day readmission and mortality rates. Alpha is set at 5% ($p=0.05$), and power is 80%.

Results: Between January and April of 2013, the ASP has made 169 interventions, of those 144 were accepted. Majority of those interventions include dose optimization, IV to PO conversions, and ensuring optimal antimicrobial selection both empirically and following culture results. The implementation of this ASP lead to a decreasing trend in length of hospitalization by 1.31 days for pneumonia and 2.70 days for cellulitis respectively. A reduction of 0.87 days and 2.62 days in overall antimicrobial use per hospital admission was also observed for pneumonia and cellulitis populations, respectively. In the pneumonia population, there was an observed increase

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of 0.78 days for oral antimicrobial use, relative to a decrease of 1.70 days for intravenous agents, which is correlated with IV to PO conversions. The cellulitis population observed a decrease in all antimicrobial use, 1.32 days for intravenous agents, and 1.33 for oral agents. The CURB-65 scores post-implementation were slightly higher and ranged from 1-5 points, compared to 0-4 for the pre-implementation period.

Conclusion: The results of this initiative demonstrate the potential benefit of ASPs on patient outcomes and overall healthcare costs at a small rural community hospital. In addition to clinical benefits, an interdisciplinary ASP also provides a platform to prepare future pharmacists to implement similar programs. Since the inception of the ASP over forty pharmacy students have been trained in this model. The preliminary results of this initiative have been used to justify expansion of this program to two other hospitals in Hawaii with plans to partner with the department of health to implement similar programs statewide.

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4-178

Category: Small and Rural Pharmacy Practice

Title: Retreatment with vancomycin in a patient who experienced significant drug accumulation in 2008

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Rabiah Dys

Case Report

Purpose: Concerns over nephrotoxicity associated with vancomycin trough levels (VTLs) greater than 15mcg/mL prompted the pharmacists to initiate and closely monitor a conservative vancomycin dosing regimen. In 2008, this patient had VTLs which were greater than 15 mcg/mL for seven consecutive days while receiving no vancomycin. The incidence of toxicity increases with duration of therapy; therefore, initial trough concentrations serve as a prognostic indicator for nephrotoxicity.³ Nephrotoxicity is defined as a serum creatinine (SCR) increase of 0.5 mg/dL. There was no SCR increase in this patient in 2008. However, at a subsequent admission in 2014 when vancomycin was ordered for cellulitis, an effort was made to prevent vancomycin accumulation. To compare repeat vancomycin administration in a patient who in 2008 demonstrated a lack of vancomycin clearance. This assessment includes SCR values, VTLs, anthropometric values (AV), and drug dosages. Values for SCRs, VTLs, AVs, and drug dosages during the patients 2014 admission were compared to the same values in 2008. Based on the patients prior experience with vancomycin accumulation, the 1 gm daily intravenous (IV) dose was decreased to 500mg IV daily even though the VTL returned at 14.9 mcg/mL. Two days later, a repeat VTL showed a level of 14.8 mcg/mL. In 2008, the SCR ranged from 1 to 1.3 mg/dL, the patient weight was 90.9 kg, the height was 172 cm, and no additional vancomycin was given during this hospitalization at Montfort Jones Memorial Hospital (MJMH). The 2014 admission a VTL of 14.9 mcg/mL followed by a VTL of 14.8 mcg/mL, one SCR of 1.9mg/dL, a patient weight of 85.3 kg, a height of 173 cm, and an initial dose of 1 gm IV daily which was decreased to 500mg IV daily. The length of stay (LOS) in 2008 was much longer at 36 days since the patient was admitted to swing bed for rehabilitation following total hip replacement as compared to a 4 day LOS in 2014 acute admission for cellulitis. A prior patient experience with vancomycin accumulation, which was presented in a 2008 American Society of Health System Pharmacists (ASHP) poster, Pharmacy monitoring of vancomycin accumulation in a patient following total hip replacement, helped the pharmacists to proactively adjust the same patients vancomycin regimen at a subsequent admission even though the VTL level was within the appropriate range and drawn at the correct time. Despite the lack of data on managing patients with persistent VTLs without continued dosing,³ our patient was managed successfully with a cautious therapeutic approach. References: 1 Lodise TP, Patel N, Lomaestro BM, Rodvold KA, Drusano GL. Relationship between Initial Vancomycin Concentration-Time Profile and

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Professional Poster Abstract

4-179

Category: Administrative Practice / Financial Management / Human Resources

Title: A phased health-system and local hospital approach to reduce intravenous acetaminophen utilization

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Purpose: Intravenous (IV) acetaminophen is a new dosage form for an old medication that carries a substantial price premium over the oral therapy yet evidence of superiority for pain management over oral therapy is lacking. Considering the importance that the nation has imposed on controlling health care costs, it is critical that hospitals act as good stewards of healthcare resources and costs while maintaining excellent clinical care. University Hospitals Health System (UHHS) recently experienced rapidly escalating costs of IV acetaminophen, therefore a series of interventions were implemented to reduce utilization.

Methods: UHHS is a complex health-system composed of a university-affiliated tertiary care facility and eight community hospitals. The system implemented a multi-level, phased approach to IV acetaminophen cost containment. Beginning in January 2014, the health system Medication Safety and Therapeutics Committee approved a restriction for use in post-surgical patients with a maximum of 4 doses. This restriction was built into the electronic medical record to facilitate appropriate ordering. IV acetaminophen usage was monitored monthly, and trends reported to the individual hospital pharmacies, and although existing restrictions were impactful, it was evident additional actions were required to ensure appropriate use. In May 2014, one of the community hospitals initiated a snap-shot drug use evaluation to assess restriction compliance and to identify additional opportunities for limiting IV acetaminophen use. Simultaneously, the price of IV acetaminophen increased substantially and unexpectedly. As a result, a letter was sent to all UHHS physicians to educate them about the cost of IV acetaminophen as well as appropriate alternatives for use. Additionally, an aggressive pharmacist initiated intravenous to oral substitution was implemented. Further formulary actions are pending.

Results: After the system-wide 4 dose limit for IV acetaminophen, a 28 percent reduction was observed in overall cost the following month. The community hospital-based drug use evaluation of 62 patients over a 2-week period revealed the average number of doses administered post-operatively on the regular nursing floor was 4 doses. Although the restriction was followed, 74 percent of patients on IV acetaminophen, were tolerating other oral medications prior to or with the second dose, thereby demonstrating an average excess of 3 doses per patient. At the same community hospital the physician letter campaign as well as an aggressive approach to pharmacist initiated intravenous to oral conversions decreased use over the previous month by 63

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percent. As a health-system, UHHS continues to track the number of monthly doses and monthly cost of IV acetaminophen for each hospital. The data is adjusted for patient volume for better comparison within and between facilities. From peak utilization through May 2014, UHHS demonstrated a 32 percent decrease in doses of IV acetaminophen. However, due to the aggressive pricing of IV acetaminophen that took effect in May 2014, the actual financial savings have become much less than expected and are driving further assessment and action.

Conclusion: Pricing of new pharmaceuticals will always be a controversial topic as will the management of medication costs, especially when one medication may cost a system in excess of one million dollars. While the reactive health-system and local hospital interventions to contain IV acetaminophen use have been effective, they are still ongoing. Proactive cost containment also remains an important strategy. One proactive strategy that is being coordinated between the health-system and the local hospitals is an evaluation of pharmaceutical vendor policies and access to facilities as new products enter the market that have limited or no data demonstrating superior outcomes.

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Professional Poster Abstract

4-180

Category: Ambulatory Care

Title: Adherence challenges in a pediatric warfarin clinic

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Purpose: Compliance with drug regimens is a common problem with prescription drugs. Adult warfarin clinics have reported non-adherence rates from a low of 10% to a high of 92%. Few studies have been done in a pediatric population to see if reasons for non-adherence parallel that of an adult population of not taking correctly, missed administration or failure to fill prescriptions. The purpose of this study is to identify challenges in a pediatric warfarin clinic for medication adherence and if these challenges parallel that of an adult population.

Methods: The institutional review board approved this retrospective data collection from 2011-2012 for the thirty-six patients enrolled in the ambulatory pharmacy warfarin clinic. The patients ranged in age from 3-34 years. Informed consent was waived due to collection of data that had been collected for non-research purposes. All thirty-six patients registered in the ambulatory pharmacy managed warfarin clinic for greater than 6 months were included. Charts were reviewed for all lab PT/INR results in goal and outside of goal ranges, reasons for subtherapeutic or supratherapeutic levels. All patients were questioned about missed doses, validation of current dosing regimen and obtaining prescriptions. Patients were divided into subgroups as child, 7 patients (age 1-11 years), adolescents, 18 patients (age 12-17 years) and young adults, 11 patients (age 18-34 years).

Results: An overall non-adherence rate of 14.4% for year 2012 occurred in this pediatric warfarin clinic. Missed doses reported by patients and guardians were highest for the adolescent age groups (15%) were parents/guardians were less likely to observe administration of the drug, but relied on patient reporting. Young adults had a missed dose rate of 10% whereas, the child group had the lowest rate at 4.5%. No group reported non-adherence due to failure to fill a prescription. One-fifth (20%) of the non-adherence rate was due to wrong doses and resulted in 4.7% of the labs out of range. Secondary findings are as follows: non-adherence (missed doses) accounted for 48% of the reported labs being less than goal range for the adolescent age group, 35% for the adult age group and 14% for the child group. Most common reasons for out of range INRs (international normalized ratios) were non-acknowledged drug-drug interactions by prescribers and community pharmacists in the child group (20%), activity changes 10% and dosing errors (6.9%) in the adolescent group and dietary changes (24%) in the young adult group. Therapeutic INRs were reported at a rate of 52% for this year, similar to that reported for the adult warfarin patients.

Conclusion: Use of warfarin in this pediatric population demonstrated a non-adherence rate of 14.4% and identified different challenges not commonly noted in the adult population. The most common reason for non-adherence was failure to give the correct dose. Missed doses were less of a challenge when parents and young adults administered.

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Professional Poster Abstract

4-181

Category: Leadership

Title: Cost-repositioning and antimicrobial stewardship: Daptomycin

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Purpose: Daptomycin is a lipopeptide antibiotic used for the treatment of Gram-positive infections. Daptomycin is usually used to treat resistant Gram-positive organisms or patients who are severely ill. Although daptomycin is one of the most costly antimicrobials used at our hospital, there are certain instances in which it is the most appropriate antimicrobial agent. Our challenge was to meet cost-repositioning goals and reduce the drug budget while providing evidence based, top-level care to our patients. Our aim was to create a process for antimicrobial stewardship of daptomycin while also considering cost-repositioning goals without the need for any additional pharmacy personnel.

Methods: A pharmacist reviewed the literature for indications that would require the use of daptomycin over other agents such as ceftaroline, linezolid, or vancomycin. Based on the literature review, the pharmacist drafted ideas to reduce the use of daptomycin as well as to ensure that it is used appropriately. In conjunction with the chair of the Infectious Diseases department, guidelines were created and distributed to all Infectious Disease physicians who practice at the hospital. Based on the guideline, all daptomycin orders undergo a daily review by a pharmacist to determine if they meet criteria. If not, a pharmacist and the ID physician discuss options for therapy and whether a switch to a less specialized antimicrobial is appropriate. Daily review is documented as a pharmacy intervention in the electronic medical record.

Results: As a team we determined that our best option is to first make sure a specialized agent is necessary over using vancomycin. If a specialized agent is necessary, we determined criteria for switching daptomycin to linezolid as a cost repositioning effort. Criteria for use of daptomycin included: treatment of endocarditis, thrombocytopenia, severe drug interactions with linezolid, hemodialysis, and treatment of linezolid resistant infections. When comparing the daptomycin costs from 1st quarter 2013 to 1st quarter 2014, about a 50% reduction in cost is noted.

Conclusion: We created a process that enhances both our antimicrobial stewardship and cost-repositioning efforts and does not require a significant time investment or any extra pharmacy personnel. The use of antibiotic guidelines for resistant Gram-positive infections has had a positive impact on antimicrobial cost. By choosing criteria for when certain antimicrobial agents should be used, it lays the groundwork for antimicrobial stewardship programs and reducing resistance in the future.

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Professional Poster Abstract

4-182

Category: Leadership

Title: Multidisciplinary business case development for implementation of a fully automated closed loop medication management and patient safety initiative

Primary Author: Deborah Sadowski; Email: sadowskid@deborah.org

Purpose: In an effort to enhance patient safety and increase operational efficiency, the proposed use of technology to create an elite closed loop medication safety solution was presented for budget approval. If approved, the stage would be set for our hospital to move from completely manual pharmacy and nursing workflows to a fully automated medication process, from drug acquisition to patient administration. Additionally, adoption of this technology was further expected to positively impact inventory management and cost control, waste reduction, and staff satisfaction. This case study focuses on how the multidisciplinary project plan was developed and why.

Methods: Initially, the Director of Pharmacy identified a need within the hospital for the addition of automated dispensing cabinets (ADCs) to allow for control and tracking of drug distribution while bringing other varied benefits to patients, staff, and the hospital. As the development process evolved, the DOP worked with the Chief Nursing Officer for C-suite support on a clinical level, the Chief Operating Officer and Chief Financial Officer for overall project development and data access, Medical Chairs who had previously expressed support for the addition of this technology, various department heads whose expertise was needed for project development and implementation, pharmacy and nursing managers, and front line staff whose workflow would be impacted by process changes that would occur if adopted. // Business case development was based on data gathered internally and with observation by the technology vendor. Time and motion studies for both pharmacy and nursing were performed. Workflow for pharmacists, technicians, the buyer, and nurses were mapped; data such as number of doses dispensed and dollar volume on wasted and expired medications were analyzed for hard dollar savings, and a clinical plan was developed to support the potential soft dollar returns that could be achieved. /

Results: After two previously unsuccessful attempts, the more fully developed third submission for this project was accepted for implementation. The need for the addition of automated technology was demonstrated through the development of a robust business plan and return on investment (ROI) analysis made possible by partnering with the technology vendor to capitalize on their expertise in this area. Through involving stakeholders from pharmacy, nursing, administration, finance, medical affairs, information technology, facilities, and purchasing/material management, the proposal was developed in such a way as to meet the needs of the hospital, the staff, and most importantly the patients, including increasing nursing time at the bedside as well as increasing availability of pharmacists time for implementation of new clinical activities to further drive new patient care initiatives. // Approval was gained for a two-phased acquisition over two budget years, first implementing the pharmacy solution components

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- the common technology backbone, a dispensing robot, a controlled narcotic access system, inventory management software, automated ordering/receiving software - followed by the nursing solutions components - ADCs, anesthesia dispensing cabinets, and an advanced analytics tool designed to optimize system performance through analysis of key metrics. /

Conclusion: Involving multidisciplinary stakeholders is a key element to building the business case and ROI for a project of this magnitude. The ability to show value across departmental lines and at a variety of vertical and horizontal levels enhances the buy in from both a C-suite and Board of Directors perspective, improving the chances for a positive outcome for the business case.

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Professional Poster Abstract

6-002

Category: Administrative Practice / Financial Management / Human Resources

Title: Development of a post-graduate year 2 solid organ transplant residency program at an academic medical center

Primary Author: Allison Guyton; Email: aguyton@uabmc.edu

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Purpose: The University of Alabama at Birmingham (UAB) Hospital performs a high volume of solid organ transplants each year, allowing for residents and students from many healthcare disciplines to gain knowledge in transplant care. Solid organ transplant (SOT) continues to be a favorite learning experience for pharmacy students and residents at UAB with many pharmacy residents deciding to pursue a career in transplant. Due to this repeated interest, a need was identified for a SOT pharmacy residency at UAB Hospital. The purpose of this project was to develop the core components of a post-graduate year (PGY) 2 SOT pharmacy residency program.

Methods: A review of the American Society of Health-System Pharmacists (ASHP) accreditation requirements was conducted. A gap analysis was used to assure compliance with the accreditation requirements and to guide development. A survey was distributed to other PGY2 SOT programs in the United States.

Results: The gap analysis allowed for the identification and correction of deficits in the program at UAB. The majority of deficits were related to program design. Structure, learning experience descriptions, evaluations, and a residency manual were developed based on ASHP requirements and available learning opportunities. Survey results from 32 transplant centers were analyzed and compared to the transplant opportunities at UAB. Recruitment is complete, and a resident was matched for the 2014-2015 residency year.

Conclusion: This project aimed to develop a PGY2 SOT pharmacy residency program at UAB Hospital. Core components were developed based on current residency programs in place at UAB and ASHP standards for PGY2 SOT residency programs. Full accreditation of the program is anticipated upon graduation of a resident and an ASHP on-site visit due to the work and preparation involved during this residency project.

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Professional Poster Abstract

6-003

Category: Administrative Practice / Financial Management / Human Resources

Title: Workflow platform for a health system-based specialty pharmacy

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Purpose: The University of Illinois Hospital and Health Sciences System (UI Health) operates seven outpatient pharmacies that serve patients and employees of UI Health. Patients include those with complex, chronic diseases who require specialty medications, such as immunosuppressant or anticancer drugs. The complexity of dispensing specialty medications has increased in recent years due to issues related to insurance coverage, payment, storage and handling, medication assistance, and clinical care. The purpose is to describe a series of workflow platforms that address the technical and clinical aspects of establishing specialty pharmacy services.

Methods: Specialty pharmacy services (SPS) were established in 2012 at UI Health to help patients with complex or chronic diseases access their specialty medications in the safest and most efficient manner. A call center serves as a mediator between the four workflow processes that were developed. The four workflow processes facilitate clinical and technical aspects regarding 1) referrals; 2) prior authorizations; 3) fulfillment and clinical management; and 4) medication assistance. Prior authorization (PA) referrals are generated from embedded pharmacists in outpatient specialty clinics and sent to the call center. Prior authorization technicians and pharmacy students conduct benefit verification to determine coverage eligibility and submit prior authorizations containing necessary clinical information obtained from a patient's electronic medical record. Access to patient's electronic medical records helped expedite approvals of prior authorizations. Once coverage is obtained, the call center coordinates the first fill and the clinical pharmacist provides medication teaching and training. Ongoing refill management, safety lab monitoring, clinical surveys to assess medication adherence and side effects, and prior authorization renewal is provided by the call center.

Results: Workflow processes for SPS were implemented successfully. Establishment of the call center within the outpatient pharmacy department improved patient access to specialty medications. Specialty pharmacy services filled 3,054 prescriptions in 2013, a 63.5% increase from 2012 in which 1,868 prescriptions were filled. By the end of 2013, SPS managed over 300 active patients, completed 275 prior authorizations, and shipped 1,678 prescriptions to patients. SPS revenue in 2013 was \$9 million, a growth of 18% over 2012. Medication possession ratio for patients with multiple sclerosis was 93% in 2012. Compliance with required labs for biologic response modifiers in accordance with clinical care guidelines implemented by SPS was 100%

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for new patients and 85% for continuing patients. A total of 200 clinical surveys were conducted. SPS coverage grew from Gastroenterology, Rheumatology, Neurology, Hepatitis C, and Pulmonary in 2012 to include Sarcoidosis and Sickle Cell Disease in 2013. Currently SPS receives over 100 PA referrals monthly. SPS currently is considering expansion to oral oncology.

Conclusion: Clinical and operational elements of a specialty pharmacy practice model can be incorporated within an existing infrastructure in a health system. Most specialty medications require multiple steps to be completed prior to start of therapy. This workflow model can serve as a template for other health systems seeking to implement specialty pharmacy services in their health system.

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Professional Poster Abstract

6-004

Category: Administrative Practice / Financial Management / Human Resources

Title: Outcomes of bedside medication delivery

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Purpose: Currently, several trials have been conducted to evaluate the different pharmacy interventions that increase a patient's medication adherence. None of the studies specifically targeted a hospital pharmacy's bedside medication delivery service. Cleveland Clinic Florida established a bedside delivery service for discharge medications in August, 2012. The objective of this trial is to investigate whether the implemented bedside delivery service provided at Cleveland Clinic Florida will improve medication adherence and satisfaction of obtaining medications after being discharged from the hospital

Methods: This is a retrospective survey study evaluating the potential benefit of bedside medication delivery. Patients were recruited into the study if they were discharged home with at least one prescription medication. Patients were excluded if they were not discharged home or could not speak English or Spanish. Patients that met these inclusion/exclusion criteria were contacted by investigators via telephone to complete a questionnaire. Outcomes between those who received their medications via bedside delivery were compared with those who received their medications at an outside pharmacy. Outcomes evaluated included medication adherence, medication counseling, and the overall satisfaction in the medication receiving process.

Results: 118 patients completed the survey after discharge from Cleveland Clinic Florida. 61 patients (52%) received their medications from our bedside delivery service while 57 patients (48%) received their medications from an outside pharmacy after discharge. Of those that got their prescriptions at an outside pharmacy, 7 patients (12%) did not pick up their medications within 7 days of discharge. According to patients surveyed, 97% in the bedside delivery group received counseling while only 73% in the outside pharmacy received counseling ($p < 0.01$). 87% of patients in the bedside delivery group rated their service as very satisfied, while 80% in the outside pharmacy group rated their experience as very satisfied ($p = .315$). 92% in the bedside delivery group reported it as very easy to obtain their medications while only 84% reported in the outside pharmacy group as it being very easy ($p = .240$). Medication adherence, as determined by our survey questionnaire, was not affected by bedside delivery.

Conclusion: A hospital bedside medication delivery service improved rates of patients receiving counseling on their medications with a trend toward increased satisfaction and ease of obtaining their medications.

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Professional Poster Abstract

6-005

Category: Administrative Practice / Financial Management / Human Resources

Title: Transformational change and implementation of a new pharmacy practice model in a tertiary care center

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Purpose: The American University of Beirut Medical Center is a 350-bed capacity tertiary care teaching hospital in Lebanon. Before 2013, the pharmacy practice model was primarily focused on drug distribution, with limited clinical opportunities. The pharmacy operated 24/7 with 17 full-time equivalent (FTE) pharmacists (including 2 Oncology Satellite pharmacies) and a turnover rate of 34% due to the quality of the physical workplace environment, workload and shifts. To describe the implementation of a new comprehensive pharmacy practice model with the goal of meeting the patient-centered care vision, and optimize the application of the clinical expertise of pharmacists in the medication-use process.

Methods: Staff pharmacists engaged with the leadership team to discuss work flow inefficiencies and lack of job satisfaction. The first step in this journey was the launching of the medication management performance improvement project with the goal of improving medication core processes. A scanning application through a dashboard was designed to replace the existing process of sending hard carbonated copies of medication orders, thus improving timeliness of care and allowing deployment of pharmacists to nursing stations. The physical setup was redesigned to physically separate clinical office space, and to provide segregation from the distribution functions. Departmental restructuring was initiated and included the recruitment of 17 pharmacists who were assigned to adults, pediatrics, oncology, and operation teams based on their preferences and development plan. New job description, competencies and career ladder plan were devised. In the new practice model, clinical pharmacists participated in daily interdisciplinary care rounds on the unit to resolve drug therapy problems; ensure timely medication reconciliation; provide parenteral nutrition management and dose adjust for medications that should be modified based on renal function, therapeutic drug monitoring, therapeutic interchange, intravenous [IV]-to-Oral switch and participated in collaborative care meetings and order sets devising.

Results: The scanning application improved the average turn-around time for receiving, processing and verifying physicians orders from 137 to 16 minutes and allowed the deployment of clinical pharmacists to the wards. Based on the workload each pharmacist was responsible for an area that included more than one ward, with the exception of the medical and surgical intensive care unit, neonatal intensive care unit, and Bone Marrow Transplant Unit. The ward

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areas fully covered reached 48% during 2013 (assignment of a pharmacist to cover more than one ward was considered to represent full coverage for one ward and troubleshooting coverage for the other wards). The goal of 100% clinical coverage could not be attained because of limitations on available staff and lack of technological advancements (computerized physician order entry and automated dispensing cabinets) The number of pharmacist FTEs remained relatively stable after full implementation of the new practice model (turn-over rate decreased from 34% to 6%). With the new practice model the number of pharmacist-intervention documentation for identification, prevention, and resolution of drug-related problems (DRPs) increased to 9577 for 2013 compared to 7591 for 2012 (26% increase), with an acceptance rate of 87% for 2013 versus 85% in 2012major (2% increase).

Conclusion: The daily, visible presence of ward-based clinical pharmacists fostered a change in culture toward embracing the profession of pharmacy on the ward and more requests by physicians for specialty clinics (e.g., infectious diseases, cardiology, and pain management) were placed. The new practice model is considered successful and allowed the pharmacists to be more effective and has resulted in a much more engaged pharmacy staff. The department continues to strive for greater pharmacy integration into patient care with the goal to link the clinical dashboard data to clinical outcomes of the patient.

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Professional Poster Abstract

6-006

Category: Administrative Practice / Financial Management / Human Resources

Title: Is unit dose distribution in hospitals the most efficient method ?

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Purpose: Hospital pharmacies are responsible for ensuring that every step of the medication cycle: storage, preparation, distribution and safe administration is managed effectively. Most general hospitals in Israel are using two distribution systems; bulk ward stock replenishment and individual medication order/ unit dose. Pharmacy is dispensing bulk containers without reviewing individual patient medication order for appropriateness. The main advantage is shorter turnaround time between prescribing and administering the drug. When using individual medication order system the pharmacist can review the appropriateness of therapy and closer control of inventory is possible. Practice of unit dose dispensing is not widely accepted in Israel, since there is no purchase of pre-packed unit dose medications in Israel as a distribution system. The aim of this study is to evaluate a new application, developed by our clinical pharmacists, that connects between CPOE and logistic systems to allow inventory and clinical management functions.

Methods: Barzilai Medical Center is a 500 bed general hospital. Pharmacists invented a computerized application that allows close clinical and stock supply surveillance of drugs in the wards. The application was evaluated during one year (2013). It allows pharmacist evaluation of all CPOE and creates an accurate distribution order for floor stock supply. Four internal disease wards were compared in this study; two using the new computer application and two as control. Parameters for evaluation included number and type of clinical interventions as well as drug cost/ patient/day.

Results: Number of pharmacist's clinical interventions increased by 58% in the study group with no additional manpower. Cost/patient/day decreased by 20% in comparison with control wards ($p < 0.05$).

Conclusion: Our pharmacy team created an innovative way to integrate individual medication order and floor stock supply. Our tool allows to detect, analyze and prevent cost pharmaceutical loses and to avoid drug errors.

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Professional Poster Abstract

6-007

Category: Administrative Practice / Financial Management / Human Resources

Title: Cost savings associated with dose rounding chemotherapy/biotherapy at a large academic teaching institution

Primary Author: Zaven Norigian; Email: znorigia@bidmc.harvard.edu

Purpose: The purpose of this project was to determine cost savings related to dose rounding chemotherapy/biotherapy in the hematology/oncology outpatient clinic.

Methods: A Pubmed search was completed to identify literature supporting dose rounding of chemotherapy/biotherapy. All chemotherapy/biotherapy agents dispensed by our institution were reviewed for: dose(s) of agent, vial sizes(s), and concentration to determine feasibility for dose rounding to the nearest vial size. All dose rounding was approved by the Hematology/Oncology Multidisciplinary Committee.

Results: 105 chemotherapy/biotherapy agents were reviewed. Eight agents met criteria for dose rounding to nearest vial size: bevacizumab, cetuximab, dactinomycin, gemcitabine, ipilumimab, ofatumumab, panitumimab, and ritxumab. On August 1, 2013 all new signed orders incorporated the new rounding rules via programing in our Oncology Management System. Physicians, pharmacists and nurses were able to visualize the calculated (exact) dose of the agent and the rounded dose to be administered. The physician was not allowed to alter the rounded dose or revert to the calculated dose. The nine month documented waste to the outpatient oncology pharmacy from August 2012 to April 2013 was \$571,298. From August 2013 to April 2014, when the new rounding rules were implanted, the documented waste was \$366,099 resulting in a 36% reduction in waste. Average saving on a monthly basis (\$22,800) leads to an extrapolated one-year savings on \$273,600.

Conclusion: Having automatic dose rounding built within the oncology ordering systems assures guaranteed compliance with dose rounding leading to maximum benefit of cost savings. This is a simple intervention that can assist in waste reduction of high cost medications.

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Professional Poster Abstract

6-008

Category: Administrative Practice / Financial Management / Human Resources

Title: Student characteristics associated with successful matching to a PGY-1 residency program

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Purpose: Pharmacy residencies are becoming increasingly more competitive. Identifying factors that can help predict successful matching would be helpful for students pursuing residency as well as faculty who are mentoring students. The purpose of this study was to identify predictor variables for successfully matching to a PGY-1 residency program.

Methods: A 23-question survey was distributed to final-year pharmacy students at 5 schools of pharmacy in the Spring of 2014. Questions on the survey assessed multiple factors, including grade point average; experience with leadership, research, and jobs; number of programs applied to; number of interviews; and demographics. A logistic regression model was used to identify predictor variables for matching to a residency program.

Results: A total of 577 students completed the survey for a response rate of 82%. A total of 187 (32.4%) indicated they had pursued residency training, of which 144 (77%) were successful in matching to a residency program. On multivariate analysis, female gender (aOR 2.83, 95% CI 1.23-6.53) and invitations to interview (aOR 1.54, 95% CI 1.28-1.85) were independently associated with successfully matching. Although pharmacy school GPA differed statistically on the bivariate level, the difference was small (+0.09 points for those who matched, $p=0.0388$), and it did not remain significant in the multivariate analysis.

Conclusion: Female pharmacy students and those offered multiple interviews were more likely to match to a residency program.

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Professional Poster Abstract

6-009

Category: Administrative Practice / Financial Management / Human Resources

Title: Standardization of chemotherapy inventory across a health system

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Purpose: Significant focus is placed upon using medications in the safest and most cost effective manner as supported through evidence-based medicine. Intravenous medications comprise a significant percent of drug spend on an annual basis. Depending upon the size and scope of the organization, chemotherapy agents can contribute significantly toward the carrying cost of inventory. This project focused on the process of ordering, preparing, and delivering chemotherapy medications for use within the health system. The goal was to standardize the vial sizes stocked in the pharmacy.

Methods: The pharmacy department of a 443 bed, tertiary referral, community teaching hospital evaluated the chemotherapy products that were listed in the pharmacy drug master file. The products in the master file were cross-referenced with prior purchasing records. This activity was completed at both the adult hospital as well as the separate pediatric hospital in the health system. An analysis was completed and a standardized chemotherapy inventory (product strength, vial size, manufacturer) was selected. The most common doses used were then pre-built into order entry strings using the accepted inventory to help minimize order entry errors.

Results: After implementation, the inactive items were removed from the drug selection screen within the pharmacy information system. The reduction of the extraneous items, along with the pre-built order entry strings, facilitated an easier order entry/product selection procedure. The health system was also better positioned to deal with regulatory compliance issues by being able to ensure the manufacturer/NDC used for patient billing/compliance purposes was accurately captured. Finally, having a standardized chemotherapy inventory allowed for easier instruction of the technician staff who complete the large majority of chemotherapy compounding.

Conclusion: Implementation of a standardized chemotherapy inventory allowed the pharmacy department to reduce inventory while at the same time ensuring regulatory compliance. Secondary achievements utilized the newly standardized inventory to address safety and accuracy concerns during the physical compounding process. The pharmacy staffs at both of the hospitals affected worked in a collaborative effort to help develop, implement, and sustain this initiative.

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Professional Poster Abstract

6-010

Category: Administrative practice / Financial Management / Human Resources

Title: Implementation of strategies to improve pharmaceutical waste management practices across health system facilities at the Veterans Health Administration

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Purpose: The Veterans Health Administration (VHA) conducted a nationwide evaluation of pharmaceutical management practices to develop a comprehensive strategy to minimize risks associated with management, handling and disposal of pharmaceutical wastes generated at VHA. The strategy was to identify legal requirements, audit pharmaceutical handling and waste management practices at selected VHA health system facility sites for potential areas of improvement in procurement, product management, compliance with federal and state Environmental Protection Agency regulations under the Resource Conservation and Recovery Act, the Drug Enforcement Agency, Occupational Safety and Health Administration, VHA policy and, to identify best practices and learning opportunities for VHA.

Methods: A Regulatory Baseline Assessment was developed to identify all federal and state regulations, industry best practices, and VHA policies applicable to pharmaceutical management, pharmaceutical handling and use, and waste management practices. A third-party multidisciplinary assessment team visited and audited eleven VHA hospital sites that were considered geographically representative of VHA's large healthcare system of 152 hospitals and 909 ambulatory care and community-based outpatient clinics, among other facilities. The audit was based on 40 Pharmaceutical Management competency requirements that were defined and developed from the baseline review. The 40 competency requirements incorporated various aspects of program management, product management, pharmaceutical handling and use, and waste management. Prior to the site visits, each facility completed a pre-survey to help inform the assessment team on key areas to focus on. During the site visit the team conducted a focused facility tour, including the pharmacy department, patient care wards, waste accumulation areas, and other key aspects of the facility involved in the pharmaceutical management process. The team also completed a detailed document review and group/individual interviews at each site. A consolidated capability scoring matrix was established to evaluate and assess each facility, including observed issues to focus on.

Results: The VHA identified multiple opportunities for improvement in its pharmaceutical management programs for the purchase, inventory, safe handling, use and disposal of pharmaceuticals and, was able to collect and share best practices across the VHA. As a result of these observations the VHA developed a formulary review and created pharmaceutical waste identification and segregation poster codes and developed educational fact sheets for specific drug products that were flagged as high-risk. These interventions were made to enable pharmacists to bridge gaps in training and knowledge of these practices. Furthermore, a nationwide online training program on pharmaceutical waste management practices was developed and included in the VHA Talent Management System (TMS) which was designed and

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made accessible as a knowledge-based system to all VHA employees including pharmacists to address competencies and oversight on pharmaceutical waste management.

Conclusion: A systematic evaluation identified areas for opportunities to improve waste management practices. The assessment team provided a thorough overview of the issues observed throughout site visits in collaboration with initiatives by VHAs established Green Environmental Management System (GEMS). As a result, a GEMS Pharmaceutical Management Guidance Document was developed with recommendations for training curriculum and performance metrics to assess pharmaceutical management practices. Policies for proper handling and use of pharmaceuticals are essential for a comprehensive pharmaceutical management program. Pharmacists will have the tools to utilize this training curriculum at their health system facilities to manage, handle and monitor waste management.

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6-011

Category: Administrative Practice / Financial Management / Human Resources

Title: Weathering the storm: managing morphine shortage crisis

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Purpose: The ongoing problem with drug shortages in Lebanon is rising to the level of disaster status. The affected medicines include cancer treatments, Ampicillin, and other drugs that are critical to the treatment and prevention of serious diseases and life-threatening conditions. As a result a policy was devised to have disaster plans and specific strategies in place for an unexpected shortage. In January 2014, Morphine was in shortage due to unexpected increase in demand and depletion of quota allocated to Lebanon. With an estimated duration of the shortage for months, and limited alternative options, drastic changes of practice were required

Methods: The impact of the shortage was assessed by counting the available stock which will last less than one month based on historical usage of Morphine. The formal process for identifying and approving therapeutic alternatives to Morphine failed since hydromorphone is not available in the Lebanese Market and shifting to meperidine is not a safe alternative. To ensure compliance with any action plan, key prescribing physicians) were involved in the decision-making. Based on the fact that the Pharmacy Department has an Intravenous Admixture Service, the action plan agreed upon was as following: 2- Having the Pharmacy Department prepare and dispense Morphine in the most ready-to-use form (1ml prefilled syringes of 5mg/1ml based on the most prescribed dose) to better control use and reduce waste 3- Shifting the practice of the Anesthesia Department from patient controlled anesthesia (PCA) morphine to PCA fentanyl 2- Shifting the practice of the perioperative care area from Morphine to fentanyl in the most ready use form (prefilled syringes of 50 mcg/1 ml (same concentration as for the original ampoule which is 500mcg/10ml). 3- Increasing the stock for the Oncology/hematology unit for morphine tablets and Durogesic patches to facilitate the switch of patients to these pharmaceutical forms.

Results: The mean monthly use was decreased from 1700 ampoules (distributed as 53% in anesthesia from which 32% were used for Patient Controlled Analgesia, 19% in each of the Perioperative area and Adult-Medical units, 15% in adult-surgical units and 10% in Emergency Department) to 320 ampoules of Morphine/month (81% decrease). The average waste of Morphine from the available strength (15mg/ml) decreased from 11mg to 1.6mg (85% decrease) The IV admixture service workload increased by 1.1 and 1 total budgeted hours for the technicians and pharmacists respectively per batch of 50 syringes. The shortage lasted for 6 weeks during which 1450 and 1400 prefilled syringes of morphine and fentanyl were prepared

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Conclusion: The multidisciplinary approach for the disaster plan have been successfully implemented to overcome Morphine shortage with a great impact on the pharmacy workload

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6-012

Category: Administrative practice / Financial Management / Human Resources

Title: Centralizing automated dispensing cabinet batch fill for hospitals within a integrated delivery network for workflow efficiency and inventory management

Primary Author: Barbara Giacomelli; Email: barbara.giacomelli@mckesson.com

Purpose: Centralizing the automated dispensing cabinet fill process to streamline inventory management, standardize formulary and provide workflow efficiency at the hospitals within an Integrated delivery network (IDN). By centralizing the automated dispensing cabinet batch fill redundant processes that occur at each hospitals are consolidated to one location providing workflow and inventory efficiencies at the individual hospitals.

Methods: A project team consisting of pharmacy leadership, IT, pharmacy informatics, pharmacy technicians and a consultant utilized lean six-sigma tools and resources to analyze and plan for a centralized automated dispensing cabinet batch fill. Representative batch fill data was reviewed to identify the medication line items that would be centralized to achieve a ~75%-85% batch fill. Following implementation of the centralized fill a users group continued to meet regularly to review the current process and for ongoing process improvement.

Results: 2.7FTE pharmacy technicians and 0.6FTE pharmacist fill ~500 formulary line items 6 days a week for 6 hospitals within the IDN. The Lead Technician, who oversees the centralized automated dispensing cabinet batch fill, also places orders for ~300 formulary line items directly to the wholesaler, for manufacturer package size quantities, 5 days a week. The items ordered from the wholesaler, in manufacturer package size, are delivered directly to the hospital with the routine wholesale delivery, each morning and delivered directly to the automated dispensing cabinets. With the centralized automated dispensing cabinet batch fill, the hospitals serviced by the program are able to streamline their on-hand inventory, utilize pharmacists and technicians for other patient care services and efficiently dispense medications from a centralized location for automated dispensing cabinet restocking.

Conclusion: Automated dispensing cabinet batch fill is a time consuming function that can be streamlined by centralizing to one location for multiple hospitals within an IDN. By centralizing automated dispensing cabinet batch fill, on hand inventory can be reduced, workflow efficiencies achieved and pharmacist and technician time better utilized for patient care services.

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6-014

Category: Ambulatory Care

Title: Utilizing medication assistance programs to help implement clinical pharmacy services in a Federally Qualified Health Center

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Purpose: Some physicians are welcome to the idea of clinical pharmacy services in primary care clinics. However, other providers want pharmacists to only help with medication assistance programs (MAP). The pharmacist at a Federally Qualified Health Center (FQHC) utilized medication assistance programs to document interactions and interventions with patients and physicians to gain trust and support to start clinical pharmacy services.

Methods: Medication assistance programs (MAP) are advertised in FQHCs to provide access to needed, but expensive medications for low-income patients. Pharmacists are involved in this process. Before the pharmacist credentialing process was finished at the clinic, the only access given to patients for the pharmacist was through the MAP. When the patient presented to the clinic to either fill out the application, or pick up the medication, the pharmacist provided medication reconciliation. Patient education on lifestyle modification was given to patients as needed. All encounters were documented on a medication therapy intervention and safety documentation form and transferred to an Excel spreadsheet and kept on the premises.

Results: The pharmacist saw a total of 24 patients during 19 weeks of MAP. The most common medication requiring assistance was recombinant insulin (glargine, detemir, glulisine, lispro) (N=13, 52%). After interviewing the patient, the pharmacist consulted with the provider, then documented missing medications in the electronic health records (EHR) and updated any discontinued medications that remained in the EHR. Furthermore, if aspirin was indicated, or if insulin titration was required, it was communicated immediately to the provider and further action was taken. Out of 29 recorded interventions, the top five findings were (1) patient education (N=19, 76%), (2) bridge therapy with sample medications, (3) substitute drug(s) (N=5, 17%), (4) change dose/dose interval (N=4, 14%), and (5) discontinue drug or add drug (N=2, 7%).

Conclusion: In a clinic setting where clinical pharmacy services are not well understood by some providers, using the medication assistance program to gain access to patients and building trust and rapport with those providers helped in the process of developing clinical pharmacy services. Documentation and closing the loop on communication also helped in that endeavor.

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6-015

Category: Ambulatory Care

Title: Initiation of pharmacist run osteoporosis clinic for high risk male patients

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Purpose: In recent years much emphasis has been placed on prevention of osteoporosis in women, but there has been considerably less focus placed on males. The aim of this quality improvement project was to evaluate the effectiveness of a pharmacist-run medication therapy management (MTM) clinic on the identification, evaluation, and treatment of male patients at highest risk for developing osteoporosis. Secondly, effectiveness of education provided to pharmacy staff was evaluated.

Methods: First, a search was conducted to identify male veterans at highest risk for osteoporosis within the last year from a community based outpatient clinic. This was determined by an evidence based review of male osteoporosis to be patients with a previous osteoporotic fracture, patients taking oral glucocorticoid therapy for more than 3 months, and patients who have received androgen deprivation therapy (ADT). Second, clinical pharmacists were educated regarding the osteoporosis algorithm, associated therapies, and laboratory tests. A pre and post survey was taken to evaluate the effectiveness of provided education. Third, after a provider consult was placed, high risk patients were evaluated by clinical pharmacists and treated based on the osteoporosis algorithm and education provided. Pharmacist within the clinic had the autonomy to order dual-energy X-ray absorptiometry (DXA) scans, baseline labs, and treatment including calcium, vitamin D, and oral bisphosphonates.

Results: A total of 62 high risk patients were reviewed by the MTM clinic. Twenty-two patients (34%) had appropriate evaluation and treatment per the VA algorithm during the initial review and were not enrolled into the clinic. Of the remaining 40 patients, 22 either declined enrollment, were not able to be reached, or were lost to follow up. The 18 remaining patients were enrolled into the pharmacy MTM clinic for further evaluation and treatment. Of the 18 patients enrolled into clinic, 3 were high risk due to chronic glucocorticoid therapy, 12 were on ADT, and 3 had a previous low trauma fracture. All 18 patients received a DXA scan per the osteoporosis algorithm. Fourteen patients (77%) received a new diagnosis (2 osteoporosis diagnoses and 12 osteopenia diagnoses). Thirteen patients (72%) received at least one new treatment of either calcium, vitamin D, or oral bisphosphonate. The total number of treatments between these patients was 23. The number of new treatments categorized by treatment type is as follows; calcium (10), vitamin D (10), and oral bisphosphonate (3). Six pharmacists completed pre and

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post-education surveys. The average scores of the pre and post education surveys were 70% and 92%, respectively.

Conclusion: This project outlined room for improvement in the treatment and evaluation of high osteoporosis risk males, as only 34% of high risk patients were evaluated and treated per the osteoporosis algorithm upon the initial review. The pharmacy clinic was shown to be effective in establishing a diagnosis in 14 of 18 patients, and initiating recommended treatments per the algorithm in 13 of 18 patients. These outcomes indicate the clinic may be a viable option for the future management of these patients. The education provided also appeared to be effective as noted by a 22% increase in test scores.

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6-016

Category: Ambulatory Care

Title: Design and implementation of a large integrated healthcare system ambulatory management of anticoagulation therapy utilizing a registered nurse-pharmacist model

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Purpose: To develop and implement a comprehensive, evidence-based and standardized ambulatory anticoagulation therapy management program within a large integrated healthcare system utilizing a registered nurse (RN)-pharmacist model to improve patient safety, effectiveness, access and customer satisfaction.

Methods: Clinical pharmacy specialists within a medical group ambulatory setting have partnered with RNs to create a virtual anticoagulation management model. Clinical pharmacy specialists created a collaborative practice agreement with providers to independently manage patients anticoagulation therapy in 11 clinics throughout Virginia. Evidence-based protocols were created for warfarin and new oral anticoagulant management, standardized staff and provider education modules were developed and standardized patient/caregiver education was established. RNs within the clinics assess, educate and independently provide warfarin dose adjustments per an established protocol. RNs collaborate with clinical pharmacy specialists for those patients for whom the protocols do not apply. RNs and clinical pharmacy specialists document progress notes for each patient within the same electronic medical record. An INR reminder list is utilized to track patients. A time in therapeutic range (TTR) report, adverse events tracking and clinical pharmacy specialist interventions (iVents) were developed to measure clinical outcomes.

Results: 15 RNs managed 17,704 patient encounters during the first quarter 2014; two clinical pharmacy specialists have intervened on 1,893 of those patients (10.7%). Data shows an approximate 65% time in therapeutic range for all anticoagulation patients managed during the first quarter 2014.

Conclusion: The RN-pharmacist model for anticoagulation management is innovative and focuses on the needs of the individual patient while concurrently practicing evidence-based care for an entire population. Both RNs and clinical pharmacy specialists practice to the full scope of licensure while ensuring safe and effective care.

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Category: Ambulatory Care

Title: Integrated patient care model hepatitis C pharmacy medication therapy management program

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Purpose: Hepatitis C Virus (HCV) infection is the most common chronic blood-borne infection in the United States. HCV carries a growing financial burden and is anticipated to increase with new changes to diagnosis recommendations from the CDC. Patients with HCV require complex medication regimens and without focused attention and support, the demanding course of treatment may lead to patient non-adherence and admission or readmission to the hospital and adverse outcomes. An integrated, multidisciplinary, collaborative program for patients with HCV that includes pharmacy specialty retail services coordinated with directed medication therapy management (MTM) services was designed to address this identified need.

Methods: The integrated patient care model, MTM and onsite retail and specialty pharmacy services provides the pharmacist with immediate access to medical and pharmacy records, facilitates navigation and management of the necessary paperwork to approve therapy, provides pre-screening, ensures patient education is conducted prior to initiation of therapy, coordinates refills, and enhances adherence tracking. The Program, in collaboration with the medical staff of our Hepatology clinic and a HCV Collaborative Pharmacy Practice agreement, also provides for coordinated care and enhanced transitions of care across the continuum for this at-risk population. The Practice Agreement portion of the Program enables a national MTM certified pharmacist, to initiate and/or discontinue medications, modify doses/intervals, authorize refills, and order lab tests. Patient self-management of HCV is improved through the provision of one-on-one pharmacy care consults and HCV medication education. These consults enhance patient understanding of HCV and their medication regimen by providing additional education, medication counseling, adherence coaching and assessment as well as nutrition and life-style counseling. Depression, drug use and alcohol screening tools (e.g. PHQ-9, Audit-C; DAST-10) are used during the visit to assess these risk points. Post visit telephone follow-up further enhances adherence, helps identify and manage adverse outcomes and helps prevent re-admissions.

Results: Since inception of the Program a pharmacist is available for sixteen hours per week in the Hepatology clinic setting and is supported by an additional pharmacist team member 40 hours a week in the Specialty pharmacy setting. Recently we were able to add another 16 hours to the clinic pharmacist time supported by a non-profit grant. A comprehensive pre-treatment

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pharmacist visit helps patients overcome their fears by providing education and an opportunity to have their questions answered. The pre-treatment visit proactively triages identified barriers to successful treatment. Sixty-three percent of patients in the Program successfully completed treatment and another 16% are ongoing. Among those completing therapy 83% have sustained virologic response and 17% have relapsed. Twenty-one percent discontinued treatment (10% due to non-compliance and 10% due to ADR). Patient care interventions per initiated patient include a median of 5 (range 2-14) in several categories including: ADR management, dose adjustments, drug/lab conflict, education/counseling (in addition to drug information), referral to Specialist (identified other health condition), drug added/discontinued and prescription access/refill assistance. For HCV patients eligible to receive prescriptions through our onsite retail/specialty services, (patients excluded that are contractually obligated to fill prescriptions elsewhere), we fulfilled 100% of their prescription needs.

Conclusion: Pharmacists via an integrated collaborative care model, specialty pharmacy services, and in collaboration with the care team, provide close monitoring, teaching and medication assistance, thereby positively affecting outcomes, decreasing re-admissions and economic burden. The Program enables the pharmacist to address lack of adherence to complex medication regimens, missed clinic appointments, failure to obtain medications and laboratory tests, which may not be able to be addressed in a standard physician visit. The Program practice model is important since the economic burden from HCV will increase in the face of a broader patient base and new medication therapies.

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6-018

Category: Ambulatory Care

Title: Healthcare system pharmacy transition of care program collaboration with an outpatient primary care practice to improve transitions for patients discharged from hospital to home

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Purpose: Gaps in care transitions, suboptimal communication between care providers, and patient non-adherence places patients at risk for readmission when they move from the hospital to home setting. Medication discrepancies after the transition process can double readmission rates due to adverse drug events. As a mechanism to address these identified gaps and improve medication safety at discharge and across the transition from inpatient to outpatient we collaborated with health care professionals at an outpatient primary care practice to provide transition of care (TOC) pharmacy medication therapy management (MTM) services to at risk patients admitted to our Healthcare system.

Methods: At our healthcare system, we implemented TOC pharmacy services across the continuum: admission, discharge, ambulatory care, and outpatient prescriptions services (i.e., integrated onsite retail and specialty pharmacy) with nationally certified MTM pharmacists. In an effort to enhance identification of patients at risk for readmission, we subsequently collaborated with a large outpatient ambulatory primary care practice and established a process for referrals to our pharmacy TOC program based on predefined high risk criteria. Referrals may be made by a provider, nurse, care manager, or pharmacist and are sent via secure electronic communication. The communication includes a brief patient history and list of current medications prior to admission enhancing hand-off from outpatient to inpatient and providing an additional opportunity for medication reconciliation. Inpatient pharmacists may reach out to the outpatient pharmacist team as needed with questions regarding the patient prior to the TOC visit. During the TOC visit, pharmacists perform a comprehensive review of medication and patient history, identify medication related problems, and educate through use of visual aids, teach-back techniques, and motivational interviewing to engage patients and assess their understanding. Our onsite integrated retail pharmacy proactively manages issues related to accessing medications and adherence, such as insurance coverage and transportation.

Results: Since inception of the TOC pharmacy program and collaboration with the primary care practice there have been 440 patient encounters across two hospitals. Of the patient encounters 166 represent referrals from the outpatient facility. Quality and process measures specific to the outpatient referrals include patient care stories/patient experience, and medication safety related to pharmacist interventions. Population characteristics to date reveal the following: 70% of patients are 65 years or older, 80% meet targeted criteria, average number of chronic diseases is

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seven and about 55% of patients are on 10 medications. Types of medication related problems identified include: identification of drug omission, dose/frequency adjustment, drug/lab conflict, adverse drug reaction, payer/processor issue, drug-drug interaction, drug-disease interactions, drug-dose limit. Of these interventions, 35% required further consultation with a member of the medical team. The ability of a patient and/or caregiver to reiterate back counseling points and demonstrate a level of understanding is also assessed. Teach back assessment demonstrates that 70% of patients average a 7/10 level of understanding. It is also estimated that approximately 25% of interventions potentially prevented a hospital readmission. Results of the health system assessment population are consistent with the primary care practice relative to afore-mentioned metrics.

Conclusion: Collaboration between the healthcare system and outpatient primary care practice provides an efficient means for communicating among providers, pharmacy, and care management and facilitates follow up when patients move from the inpatient setting to an ambulatory/outpatient setting. The TOC pharmacist visits facilitates enhanced inpatient/ambulatory/outpatient hand-off communication regarding medication additions or changes, allergy information, laboratory data or other patient follow up post discharge.

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6-019

Category: Ambulatory Care

Title: Implementation of a second year pharmacy resident-managed clinical pharmacy service in a federally qualified health center

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Purpose: The purpose of the Federally Qualified Health Center (FQHC) is to enhance the provision of primary care services in underserved urban and rural communities. Access to care is still an issue in these communities. Pharmacists can increase access to patient care services, in collaboration with other primary care providers, to these underserved populations. Furthermore, use of post-graduate year two (PGY2) ambulatory care pharmacy residents can further increase access to care, under supervision of a clinical pharmacy specialist. This study describes the development and implementation of a PGY2 pharmacy resident-managed clinical pharmacy service within a FQHC and evaluates patient outcomes.

Methods: This is an investigator-initiated, single-center, retrospective study evaluating the impact of the PGY2 pharmacy resident-managed clinical pharmacy service in a FQHC on patient outcomes between August 2013 and May 2014. The clinical pharmacy service operated under a collaborative practice agreement with the primary care physicians (PCPs) and offered anticoagulation, diabetes, and polypharmacy services. Outcomes related to the implementation of the service included number of patient referrals received and number of patient visits. Patient outcomes included time in therapeutic range (TTR) for patients referred for anticoagulation monitoring and glycosylated hemoglobin (A1C) for patients referred for diabetes monitoring.

Results: A total of 91 referrals were received during the study period. Fifty-four (59.3 percent) referrals were to the anticoagulation service, 29 (31.9 percent) referrals were to the diabetes service, and 8 (8.8 percent) referrals were to the polypharmacy service. Of the patients referred for anticoagulation monitoring, 44 (81.5 percent) patients were seen at least once with 300 patient visits occurring during the study period. TTR was 53 percent and TTR plus/minus 0.2 was 69 percent. Of the patients referred for diabetes management, 16 (55.2 percent) patients were seen at least once with 54 patient visits occurring during the study period. The average change in A1C from baseline was minus 2.17 percent (plus 0.1 percent to minus 4.9 percent) for patients with follow-up A1C measurements.

Conclusion: A PGY2 pharmacy resident-managed clinical pharmacy service in a FQHC is a viable practice model. The primary challenge encountered specific to a PGY2 pharmacy resident-managed service was appointment availability due to other resident responsibilities.

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Patients referred to the PGY2 pharmacy resident-managed clinical pharmacy service showed positive patient outcomes consistent with other documented clinical pharmacy services.

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6-020

Category: Ambulatory Care

Title: Virtual pharmacy senior care population management in ambulatory care setting

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Purpose: To develop a virtual pharmacy program in the ambulatory care setting that would improve patient safety, decrease adverse events, enhance pharmaceutical care, and facilitate compliance with Center for Medicaid and Medicare (CMS) Star Measure patient outcomes in senior care population management.

Methods: Clinical pharmacy specialists within a medical group ambulatory care setting identified the senior care patient population of one associated insurance payor providing a Medicare Advantage plan. The clinical pharmacy specialists completed virtual pharmacy chart reviews (VPRx) and real-time prescription reviews for each identified patient. The VPRx was completed for each patient prior to the scheduled Medicare Advantage Annual Assessment appointment, each primary care or specialty provider office visit, and each hospital or emergency department discharge encounter. The VPRx is documented as a progress note and recommendations are also communicated to providers through a direct in-basket feature within the electronic medical record. Clinical pharmacy specialists provided clinical drug therapy recommendations including medication dose adjustments, medication initiation or discontinuation, immunizations, lab monitoring, drug information, formulary interchange, and generic interchange. In addition, the clinical pharmacy specialists received an electronic best practice alert when a prescription was ordered within the electronic medical record for each patient identified. The prescriptions were reviewed to verify that they were for the right patient, right drug, right dose, right route, right frequency, right indication, clinically effective, and optimize the insurance payor formulary.

Results: Two clinical pharmacy specialists delivered the virtual pharmacy senior care program to 396 patients beginning January 1, 2014. From January 1, 2014 until March 31, 2014, the clinical pharmacy specialists provided a total of 3052 interventions which included 813 clinical interventions such as generic interchange, medication dose adjustment, and lab monitoring. There was a 70% acceptance rate of these clinical interventions by the providers. The remaining 2239 interventions included patient touch points such as prescription review and pre-visit, post-visit, and transition chart reviews. Overall, there was an average of 7.7 interventions including both clinical and touch-points per patient. In addition, the annualized cost-savings derived from

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medication discontinuation and generic interchange recommendations was \$65,186 and the annualized cost savings opportunity was \$131,687.

Conclusion: The role of ambulatory care pharmacists in providing virtual pharmacy patient-centered pharmaceutical care is innovative and focused on the needs of the individual patient while simultaneously coordinating with the care team to achieve healthcare goals for distinct populations, including those within the healthcare system and the local community.

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6-021

Category: Ambulatory Care

Title: Identification of medication related problems post hospital discharge in a community health center transitions of care clinic

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Purpose: Medications may be discontinued, added or doses adjusted when patients are hospitalized. While hospitals have discharge systems to counsel patients and communicate with primary care providers, medication related problems (MRPs) post-discharge are common and affect patient outcomes and safety. When patients transition from hospital care to primary care pharmacists can play a key role identifying MRPs. Pharmacists can reconcile medication lists, assess patients' medication knowledge and make clinical recommendations to primary care providers. The purpose of this study was to determine the feasibility of assigning a clinical pharmacist to the primary care team during transition of care clinic visits.

Methods: Hospital discharge patients were seen by a clinical pharmacist 30 minutes prior to medical provider visit. Prior to the appointment, prescription refill history and discharge summary was obtained from the pharmacy and hospital, respectively. All patients were instructed to bring their medications from home including prescription, OTC, and herbal supplements. The patient visit with the pharmacist included a review of all current medications, indications, and assessment of the patient's understanding of and adherence to their medications. The pharmacist reconciled the medication list, updated the electronic health record, and assessed medication related problems including potential and actual adverse drug events. An encounter form was created and utilized to facilitate the appointment and data collection and communication of recommendations to the provider immediately after the visit with the pharmacist. A brief hand-off occurred between the pharmacist and medical provider to discuss medication related problems and any clinical or medication recommendations. After each appointment, the number of medication related problems were documented in the pharmacy database.

Results: Eleven post-hospital discharge patients were seen by a clinical pharmacist prior to the medical provider appointment. 61 medication related problems were identified including 24 potential adverse drug events and 2 adverse drug events. The medications resulting in adverse drug events resulted in either dose reduction or discontinuation. MRPs identified included untreated medical problem, adverse drug reaction, labs required, and poor adherence, all of which were discussed with the medical provider to improve quality of care.

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Conclusion: Assigning a clinical pharmacist to transitions of care visits led to identification and intervention of many medication related problems and may also result in decreased overall costs to the healthcare system.

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6-022

Category: Ambulatory Care

Title: Pharmacist managed insulin titration clinic's impact on highly uncontrolled diabetes patients

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Purpose: Interventions, such as telephone call follow-ups, and formal educations have all demonstrated that they can assist patients achieving their glycemic goals. With current patient volumes, increasing administrative requirements of physicians and reimbursement rates for non-clinic visits, providers clinical time is constrained. As a result, the time between primary care visits averages approximately 1-3 month(s). In addition, transportation can be challenging for Navajo patient population which can be alleviated through phone calls. A pharmacist managed insulin titration clinic was developed to serve those patients with elevated A1Cs that were unable to meet their goals through traditional visits with their providers.

Methods: Base line was the date of the initial education session. Subjects were excluded if they missed 3 consecutive visits or more, did not have pertinent lab data such as A1c, or if the subjects were referred to pharmacy managed insulin clinic less than a month. The control group included subjects on insulin therapy followed by their PCP with no pharmacist intervention. Also, control subjects were required to be seen by their provider regularly, needed to be on insulin therapy, and be seen by same providers for at least a year. Subjects were excluded if they had any interaction with the clinic pharmacists, gestational diabetes patients, type I diabetes patients, patients with no lab data, or patients who were seen by endocrinologists. An initial visit includes education on A1C goal, definition of hypoglycemia, signs and symptoms of hypoglycemia, how to self manage hypoglycemia, sick-day management, and fasting blood glucose and post-prandial blood glucose goals. After the initial session, patients were followed by weekly telephone calls. Each follow-up includes review of self-monitoring of blood glucose (SMBG), and any hypoglycemia episode. Based on SMBG readings, pharmacists will adjust insulin doses without consulting the PCPs. Both groups were followed and observed for 12 months

Results: 40 patients were referred to the pharmacist-managed insulin titration clinic. 32 subjects from pharmacist-managed insulin titration clinic and 32 subjects from clinic were included in the study. The primary outcome of mean change in A1C showed a 2.1% decrease in intervention group and a 1.2% decrease in the control group (P=0.019). Based on the result, the secondary outcome was not statistically significant. 3 patients from the intervention group and 1 patient from the control group visited ER due to hypoglycemia; however, the p value was 0.30 (failed to reject null hypothesis which means there is no difference between two groups). Another

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secondary outcome was to measure the number of self-corrected hypoglycemic episodes. There were 76 hypoglycemic episodes in the intervention group, and 73 out of 76 hypoglycemic episodes were self-corrected by the patients. Due to lack of documentation, we could not measure the number of hypoglycemic episodes or self-corrected hypoglycemic episodes in the control group.

Conclusion: The pharmacist managed insulin titration clinics patients insulin doses were individualized based on their SMBG readings and medical factors. Due to the transportation difficulties and financial constraints that our population experiences, telephone follow-up was acceptable method for more frequent patient contacts and provided more convenience for our patient population. Through the pharmacist managed insulin titration clinic, we were able to show that more frequent contact with patients can improve glycemetic control. In addition, the intervention group showed a 96% success rate of self-correction of hypoglycemia which demonstrated the impact of frequent education regarding hypoglycemia self-treatment by the pharmacists.

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6-023

Category: Ambulatory Care

Title: Meeting contraceptive needs of teens outside the four walls of a federally qualified health center (FQHC): a pharmacy model

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Purpose: Federally Qualified Health Centers (FQHCs) are a source of primary care for uninsured and under-insured women of reproductive age. The range of family planning services being provided and the methods for actually delivering these necessary contraceptive medications to meet patient needs requires easy access for patients. The purpose of this poster is to summarize a model for an FQHC contract pharmacy to prepare and provide all contraceptive medication needs to teens attending 4 off-site schools. The FQHC pharmacy coordinates dispensing of medications to schools located in low-income areas to increase access to care for students during school hours.

Methods: The partnership between the school based clinics and FQHC contract pharmacy determined the need for contraceptive medication dispensing at the various schools. It was determined that the main site FQHC contract pharmacy was best equipped to provide these birth control medications to the various affiliate schools. The requested contraceptive medications are being provided to 4 off-site schools associated with the FQHC school based program. A specific pharmacy preparation and delivery service was designed to meet the unique requirements of each respective school. The pharmacy services model includes prescriptions required for patient-specific needs identified for each school by the provider. The pharmacy created an order process customized for all of the school based clinics. The orders are entered into an electronic ordering system and pharmacy confirms a list of all patients with designated school personnel. Pharmacy further ensures orders are prepared and allocated for delivery by designated date. All orders are organized and the pharmacy role is defined. The pharmacy service for school-based clinics is incorporated into the prescription processing system in terms of ordering of medications and proper documentation. Billing is based on patient specific insurance or self-pay status.

Results: This collaboration between the FQHC contract pharmacy and school-based clinics allowed for access to care and a mechanism of delivering a much needed family planning option with contraceptive medication dispensing to teens in low-income areas through a school-based clinic. Contraceptive needs varied for each respective school-based clinic and included the range of oral contraceptives, injection, ring, patches, IUDs, as well as emergency contraception. Overall, a model of an FQHC contract pharmacy prepared contraceptive medications protocol

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was designed and implemented successfully for affiliated off-site school based clinics in order to assist students during school hours.

Conclusion: FQHC contract pharmacy is best established to offer this unique family planning program to school based health centers in a timely manner. This allows patients increased access to quality care and further contributes to positive outcomes such as significantly increasing compliance as well as decreasing drop-out rates and unintended pregnancies among low-income teens within their own community.

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Professional Poster Abstract

6-024

Category: Ambulatory Care

Title: Implementation of a pharmacist-run Annual Wellness Visit in an outpatient primary care practice

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Purpose: The Affordable Care Act added the Annual Wellness Visit (AWV) benefit for Medicare beneficiaries January 2011. The AWV addresses health maintenance activities including medication reconciliation, screenings, diagnostic testing and referrals. Recent literature notes successful pharmacist-run AWV service implementation, but guidance is lacking for overcoming administrative challenges for activities that may be outside of the typical outpatient pharmacist role. This case describes the successful implementation of a pharmacist-run AWV service pilot in an outpatient primary care practice and one practices approach to administrative challenges include ordering procedures, billing, recruitment and documentation.

Methods: Service development for a pharmacist-run AWV began in October 2013 with a clinic pilot proposal including a clinic-specific protocol and visit work flow. The administrative team lead by a PGY1 pharmacy resident included the family medicine clinical pharmacist, nurse manager, front staff manager, medical director, as well as billing and compliance representatives. Attending physician faculty were included in final service pilot review and approval. Potential patient volume and clinic need was identified using existing clinic reporting including payor and visit information and a polypharmacy report. Based on group consensus, other materials created included a telephone recruitment script, standardized documentation procedures, and quick references for visit providers. Evaluation of pilot service implementation with a focus on non-medication ordering activities was approved by the system Quality Improvement Review Committee. Reimbursement and recruitment information was also reviewed.

Results: The team approach to pilot service development, implementation, and review identified key language and protocol items required to secure buy-in from administrative stakeholders in multiple areas. Initial administrative approval was secured in October 2013, with faculty physician approval in December. Patient recruitment began in December and the AWV service pilot began January 2014. Pharmacists placed non-medication orders in the majority of patient encounters. The AWV service pilot allowed pharmacists to address the potential barriers encountered with billing, administration, documentation, pharmacist and physician comfort, patient care and ultimately find solutions to these barriers. Upon administrative team review of the pilot, the service was unanimously voted to be continued, with changes to physician supervision of pharmacists, and procedures for ordering labs, radiology and referrals. The next steps planned for the practice encompass the development of a collaborative practice and stricter protocol to limit inter-provider variability, as well as an office-wide documentation guide to standardize pharmacist and physician AWV patient care notes.

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Conclusion: Team development of a service pilot under guidance of a pharmacy resident is an effective method to implement a primary care pharmacist service.

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Professional Poster Abstract

6-025

Category: Ambulatory Care

Title: Patient satisfaction with health-system based specialty pharmacy services compared with usual care

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Purpose: The Ambulatory Care Pharmacy Department at an urban academic medical center established specialty pharmacy services that manage and address the challenges of dispensing specialty medications. A patient satisfaction survey was created to 1) to compare and contrast patient satisfaction with health-system based specialty pharmacy services (HS-SPS) versus other pharmacies that dispense specialty medications, and 2) to investigate potential opportunities for the HS-SPS to expand or improve its services.

Methods: Investigators developed a survey to assess satisfaction with pharmacy services in patients taking specialty medications for gastrointestinal disease, multiple sclerosis, and rheumatoid arthritis. Patients were contacted via telephone after three monthly fills of a prescription for a specialty medication written by a physician at the health system. Surveys were offered from January 2014 to April 2014. Data collection was discontinued once a total of 100 patients agreed to answer the survey; 50 patients received their specialty medication from the HS-SPS, and 50 patients received their specialty medication from other pharmacies. The institutional review board approved this survey.

Results: A total of 308 patients were called. Of the 100 patients who agreed to take the survey, 96 completed all questions. For all response categories, patients were consistently more satisfied when receiving services from the HS-SPS. The greatest difference was seen in patients rating their satisfaction based on effective communication between pharmacists and physicians. Eighty-four percent of patients who filled medications with the HS-SPS rated their pharmacist-physician communication as excellent compared to 39% of patients with other pharmacies. More of the HS-SPS patients rated their overall specialty pharmacy services as excellent in comparison with patients who filled prescriptions with other pharmacies (80% vs 59%). Patients reported that different pharmacies provided different types of specialty pharmacy services. Only 4% of patients from the HS-SPS reported never having received clinical calls compared to the 47% of patients from other pharmacies. Furthermore, patients from the two surveyed groups valued and requested different services. The most common request from patients who received their medication from the HS-SPS was for improvement in drug dispensing (refill options, payment, and shipment). The most common request from patients who received their medication from other pharmacies was for improvement in communication (communication between physicians, pharmacists, and insurance plans).

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Conclusion: Patient satisfaction with pharmacy services differs among pharmacies. Within the HS-SPS, increased physician-pharmacist communication was associated with greater patient satisfaction. Communication between pharmacists and physicians can facilitate appropriate patient care and specialty drug delivery. Pharmacies that operate outside of a health-system or medical center can use this survey to meet the needs of patients who requested specific service enhancements. By strategizing to improve communication among physician, pharmacists, and insurance plans, pharmacies can strive to offer patients continuity of care that is similar to HS-SPS. Additionally, HS-SPS can continue providing its valued services and offer patients more flexible dispensing options.

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Professional Poster Abstract

6-026

Category: Automation / Informatics

Title: Applicability and effectiveness of robotic device for preparation of anticancer agents in Japanese hospitals

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Purpose: In Japan, pharmacists are the main professional in charge of preparation of anticancer agents, and the risk of wrong preparation as well as occupational exposure are larger matters of concern than before. Recently, robotic devices has attracted much attention as a promising solution for the accurate and safe preparation of infusion anticancer agents, however, there has been no robotics satisfying prerequisites for preparations of both liquid and lyophilized agents in Japan. In the present study, APOTECACHemo™ (LOCCIONI, Italy), a robotic device for preparation of anticancer agents, was introduced to Mie University Hospital, and its applicability and effectiveness were assessed.

Methods: For the benchmark testing, fluorouracil solution (5-FU® Injection 250 mg, Kyowa Hakko Kirin Co. Ltd., Tokyo, Japan) and cyclophosphamide powder (Endoxan® for Injection 500 mg, Shionogi & Co., Ltd, Osaka, Japan) were prepared either by robotic device or by hand in the biosafety cabinet, and the mean precision accuracy (%) and preparation time (min) were compared between robotic device and manual preparations. The average time for the individual preparation in the clinical setting was calculated by dividing hours of robotics operation by the total number of preparations per month. The robotics were customized to fit the syringes from Terumo Corporation (Tokyo, Japan), which is widely used in Japan, and evaluated the applicability. The coverage of the robotics in the clinical setting was assessed by dividing the number of preparation by the robotics by the total number of preparations for inpatients.

Results: Of the 58 vials tested, only one vial was not suitable for the robotic device because of small size. When fluorouracil (800 mg/16 mL) and cyclophosphamide (400 mg/20 mL) were prepared 20 times each, the mean precision errors by robotics and by hand were -0.68% and 1.08% for fluorouracil, and -0.41% and 1.43% for cyclophosphamide, respectively. The mean preparation time of fluorouracil by the robotic device and by hand were 5.1 min and 1.4 min, respectively, and those of cyclophosphamide including dissolution were 16.4 min and 6.2 min,

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respectively. In addition, the mean preparation time could be shortened by 30% by performing multiple preparations at a time in the clinical settings. The Terumo syringes fit to the robotics after modification of carousel. The coverage of the robotics was 25.4% initially, and elevated to 65.6% after improvement of carousel in the loading chamber as well as algorithm of the robotics movements. Furthermore, the robotics could manipulate high dose vials for multiple patients safely even though the vials available in Japan are designed for the single use. The robotics has been used for the daily preparations of anticancer agents in the hospital for more than 13 months without critical trouble.

Conclusion: Most of the vials tested and the syringe available in Japan were applicable to the robotics. The robotics shows higher precision accuracy and manipulates multiple vials safely at a time with less prior arrangement than the manual preparation. It is considered that the robotics can be operated safely either by pharmacists or the experts without expertise of pharmacists. Overall, the robotics would advance the quality and the efficacy of the oncology pharmacy practice in Japanese hospitals.

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6-027

Category: Automation / Informatics

Title: Implementation of computerized prescriber order entry (CPOE) in the outpatient setting.

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Purpose: The implementation of a computerized prescriber order entry (CPOE) in the outpatient setting in a large academic medical center is a multi-disciplinary collaborative effort. This was initiated by the meaningful use initiatives highlighted in the Health Information Technology for Economic and Clinical Health Act (HITECH act) which was part of the American Recovery and Reinvestment Act (ARRA) of 2009. We will highlight the steps which were taken to implement the medication administration process for outpatient CPOE and lessons learned as well.

Methods: In order to facilitate the implementation of the CPOE, a sub-committee group was formed which included medication administration (pharmacy), radiology, pathology, and consults orders. Third party consultants were the lead on the project. The medication administration team consisted of an IT pharmacist as the sub-committee lead, third party consultants, vendor analyst, nursing administration and a physician champion. There were 42 clinics that had to be addressed and the floor stock medications were reviewed. The design included medications and vaccines which could be administered in clinic. The appropriate orderable (medication name in the electronic medical record (eMAR)) and common dosing parameters were built for the medications and vaccines. A medicine-pediatric specialist and a pediatric clinical pharmacist were consulted regarding the build of the vaccines. Once the medication build was completed, it was tested, and then piloted in a few clinics. Once the pilot was completed, then the implementation was rolled out to the rest of the clinics.

Results: The whole project took 18 months to complete. All clinics adapted to the new method, but the billing for medication was not accounted for since it was introduced late into the project. Since medication billing was introduced towards the end of the project only vaccination billing was accounted for. Complex IVs from Oncology and Renal clinic was not included in the project.

Conclusion: This implementation allowed medications to be ordered and charted within the medication administration section of the eMAR. It also allowed consult orders, pathology, and radiology orders to be placed with the CPOE system. Since the information is now in the eMAR, information is in one standard location. The process could have taken other things into account such as billing which the UIC medical center is currently working on. The ambulatory care administration is working with pharmacy administration, the Information Service department, and a third party billing consultant to see if we can solve the billing issues.

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6-028

Category: Automation / Informatics

Title: Combating alert fatigue: eliminating irrelevant alerts through decision support assisted drug-drug interaction checking.

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Purpose: Medication safety checking in the Netherlands is based on a nationally maintained drug database (G-standard), but is (similar to the US) plagued by a large number of irrelevant alerts. In addition, medication safety software typically generates alerts when a medication order is initiated or modified, while the deleterious effects of many harmful drug combinations occur after several days. This case quantifies the effects on number of DDI alerts and pharmacist time savings of decision support assisted drug-drug interaction (DDI) checking.

Methods: We implemented a commercially available clinical decision support system (CDSS) to augment standard DDI checking by adding laboratory results values, patient demographics, co-medication and administration times to the conventional drug-drug interaction and renal failure contraindication algorithm. The CDSS is based on the national DDI and renal dose checking knowledgebase and is updated monthly. Furthermore, the CDSS evaluates active medication orders for non-ICU inpatients three times daily. This enables us to monitor the effects of a potentially deleterious drug combination over time. Last, the CDSS contains a clinical rule editor which allows us to group DDI's that require the same intervention, greatly reducing the number of clinical rules required to perform CDSS assisted DDI checking. Both conventional DDI-checking (reviewing DDI log files 3 times daily) and CDSS assisted DDI checking were performed on the same patient population. The number of alerts for pharmacists and prescribers and pharmacist time spent on performing the DDI checking task were compared.

Results: We found that only 29 DDIs caused 86% of DDI alerts. We assembled a multidisciplinary team who evaluated these DDIs for clinical relevance and the need to alert the physician at the point of prescribing. The CDSS was then used to further increase the relevance of 18 DDI alerts by adding additional patient or medication specific parameters (such as laboratory values and administration times) to the standard DDI algorithm. No less than 14 of these 18 DDIs were refined using only 4 clinical rules: 1 gastric-protection rule (6 DDIs), 1 hyperkalemia rule (3 DDIs), 1 hypokalemia rule (3 DDIs) and 1 hyponatremia rule (2 DDIs). Our approach resulted in a 45% reduction in pharmacist time spent on DDI checking and a 55% and 74% reduction of the number of alerts for pharmacists and prescribers respectively.

Conclusion: A national knowledgebase allows for efficient implementation of a CDSS to assist in DDI checking. Adding only a few additional patient variables to the conventional DDI checking results in a large decrease in irrelevant alerts and increases efficiency. Our approach has resulted in expanding pharmacists medication checking activities (such as dose checking in patients with renal failure) without adding more staff.

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6-029

Category: Automation / Informatics

Title: Description and evaluation of RFID-based technology to automate medication kit processing

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Purpose: Pharmacy departments routinely process medication-based kits (including trays and boxes). Standard practice is for each kit to be returned to the pharmacy after the kit has been opened or before the kit expires. Pharmacy personnel usually perform all core processing elements, including inventorying returned kits, identifying the dosage units that need to be replaced, restocking the kits with those elements, and verifying content accuracy. Radio Frequency Identification Devices (RFID) Technology provides an automated alternative. This case describes the functionality of the RFID technology and reviews an evaluation of the time spent in processing kits using the manual and automated processes.

Methods: The author measured (timed) the processing (inventorying and stocking) and checking (verifying) the contents of the kits as two separate measurements using the manual and automated processes, that is, before and after installation of the RFID technology. Technicians processed the kits, and pharmacists checked the kits. This evaluation was conducted in two separate institutions. A variety of kits were evaluated, including emergency code cart trays (adult and pediatric), operating room-based kits, and procedure-based kits.

Results: The author will review the science and operation of the RFID-based medication kit process. The author will also review the primary functional differences between the manual and automated processes. The author will review the results of the time evaluation, including a statistically-valid comparison of time spent processing the kits using the manual and automated processes, time spent checking the kits using the manual and automated processes, and total time using the manual and automated processes. The author will review some of the transition challenges.

Conclusion: An automated RFID-based technology provides an alternative to the routine manual process for processing medication-based kits. /

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6-030

Category: Automation / Informatics

Title: Implementation of a centralized automated storage system in a hospital pharmacy: what about return on investment?

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Purpose: A centralized automated storage system Rowa (ARX) was implemented in our hospital pharmacy in 2008, in order to optimize and secure the medication process. Initially, a projected return on investment (ROI) was calculated to justify the investment for the hospital financial department. The main objective of this study was to compare the originally projected and the real ROI, after 6 years of using and an important upgrade of the automated storage system. This upgrade was due to the widespread of datamatrix codes on drug boxes in 2013, and recurrent failures and technical problems of the robot.

Methods: Real ROI (i.e. balance between cost investment and cost saving) was calculated annually until the sixth year of robot use (2014), by deducting the cost of investment from the cost saving since robot implementation. Cost savings were evaluated by the reduction of the drugs stock and the decrease in pharmacy staff dedicated to global dispensing. Investment costs included robot implementation, maintenance, repairs and the system upgrade in 2013. We calculated the difference between this real ROI and the ROI that was projected when buying the system, for the sixth year of use (2014). The real payback period (i.e. the period of time required to recoup the funds expended in the investment) was then determined, and compared with the expected payback period. The hospital chose to upgrade the robot with a new system but we will present the ROI if the choice was made to modify the old robot to integrate three datamatrix scanners.

Results: After 6 years of using robot (2014), total cost savings were +911,010\$, divided between decreasing drug stock value (+75,850\$), and reduction of pharmacy staff in the dispensing area from two assistant technicians and one pharmacy technician (+835,160\$). Total of investment costs were -941,860\$, divided between the acquisition cost (-483,690\$), the maintenance cost (-153,410\$), the repairs (-30,570\$) and the upgrade (-274,190\$). Finally, balance between cost investment in one hand and cost saving in the other hand had been -30,850\$ after 6 years of use (2014). In 2008, originally projected ROI for the year 2014 was +241,990\$, i.e. an overestimation of 272,840\$. This difference was mainly due to the important and unplanned upgrade of the system during the 5th year of use (2013). The real payback period has been

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increased by approximately 2 years (6 years of use, instead of 4 years as expected). If the choice was made to add datamatrix scanners to the old robot, the upgrade would have cost 65,000\$ instead of 274,190\$. And balance between cost investment and cost saving would have been +178,340\$ instead of -30,850\$.

Conclusion: Despite their cost, centralized automated storage systems are a worthwhile investment, leading to a return on investment within a few years. When purchasing a robot, economic projections should be calculated with caution, because of technological and regulatory changes that can lead to a premature obsolescence of the system. These economic considerations should be put into perspective with the benefits: optimization of drugs stock management, greater efficiency of the global dispensing process, securitization of medication process, and redeployment of pharmacy technicians to value-added activities, as unit dose drug daily dispensing system or management of automated secure dispensing cabinets in care units.

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6-031

Category: Cardiology / Anticoagulation

Title: Anticoagulation with rivaroxaban in post cardioversion patients (ARC)

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Purpose: Rivaroxaban is a Xa inhibitor that has been proven non-inferior to warfarin for the prevention of stroke in non-valvular atrial fibrillation in the ROCKET-AF trial; however, the use of rivaroxaban for the prevention of stroke in the immediate post-cardioversion period has not been studied. Patients undergoing cardioversion have an embolic risk of 1-5% and therefore require anticoagulation for one month. Anticoagulation with enoxaparin during this time requires expensive injections and bridging with warfarin that requires intense follow-up, lab monitoring, and time.

Methods: This is an institutional review board approved prospective, unblinded, interventional, with historical control study of 33 non-valvular a-fib patients cardioverted between October 2012 and May 2014. Inclusion/exclusion criteria: signed informed consent, patient age 18 and older, creatinine clearance 15 ml/min and higher, requiring electrical cardioversion and no recent bleeding. Patients received anticoagulation with enoxaparin or fondaparinux or rivaroxaban before cardioversion and with rivaroxaban 20mg tab daily at dinner for 30 days after cardioversion. All patients were followed up by weekly telephone calls using a standardized patient questionnaire to assess rivaroxaban efficacy of thrombosis prevention and the incidence of both major and minor bleeding.

Results: There were no thrombo-embolic events reported (p=NS). Major bleeding (GI bleed secondary to aspirin and OTC NSAID use) occurred in 3.03% (1/33) of patients and there were zero minor bleeds reported. Total bleeding was 3.03% (1/33) for rivaroxaban similar to warfarin historical control bleeding of 3.1%.

Conclusion: Anticoagulation with rivaroxaban post cardioversion is non-inferior, simpler, and more cost-effective compared to warfarin therapy with enoxaparin / fondaparinux bridging. Reinforcement of aspirin discontinuation when not clearly indicated and NSAID avoidance is key to minimizing bleeding. The ease of rivaroxaban administration, absence of required monitoring and cost savings compared to bridging with warfarin treatment presents an appealing new treatment option.

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6-032

Category: Cardiology / Anticoagulation

Title: Risk factors for hospitalization for major bleeding in patients prescribed dabigatran or rivaroxaban

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Purpose: The new oral anticoagulants dabigatran and rivaroxaban are being used increasingly for the prevention of stroke and systemic embolism in patients with non-valvular atrial fibrillation, deep venous thrombosis prophylaxis after orthopedic surgery, and the treatment of venous thromboembolism. Although these medications have similar efficacy to warfarin, less is known regarding reversal of these agents and risk factors for major bleeding. The objective of this retrospective chart review was to determine which risk factors are associated with hospitalization for major bleeding in patients prescribed dabigatran or rivaroxaban.

Methods: Retrospective, case-control study conducted at two medical centers in the Phoenix metropolitan area. Patients prescribed dabigatran or rivaroxaban, who experienced a major bleed from June 1, 2011 to August 31, 2013 were identified using the Banner Health electronic medical record and were eligible for inclusion into the study. Patients were excluded if they were not on either study drug, or did not meet the International Society on Thrombosis and Haemostasis (ISTH) definition of major bleeding. Each case of major bleeding was matched to four control patients based on drug, indication, month and year, and hospital. The primary objective was to determine which risk factors were associated with hospitalization for major bleeding. Secondary objectives included determining if the HASBLED score (hypertension, abnormal renal/liver dysfunction, stroke, bleeding history, labile INR, elderly, drugs) correlated with incidence of major bleeding. Risk factors with a p-value <0.05 were identified by a univariate analysis and were subsequently entered into a multivariate logistic regression model and removed in a stepwise manner if p >0.05. The variables with a final p-value <0.05 in the multivariate regression model were considered to be significant contributors to bleeding and were deemed risk factors.

Results: In total, 38 major bleeds were identified (cases). Twenty-three bleeds occurred in patients receiving rivaroxaban, and 15 patients were taking dabigatran. The primary indication for use of oral anticoagulation was atrial fibrillation, and the most frequent type of bleed was gastrointestinal. Overall, baseline characteristics were similar between groups. The median age within the bleeding cohort was 79 vs 76 years for the control patients. The mean CHADS2 and HASBLED scores were 2 (SD=1). The HASBLED score did not correlate with major bleeding events in this cohort. In the unadjusted univariate analysis, statistically significant risk factors for

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major bleeding included low albumin, elevated aspartate aminotransferase (AST), age > 65 years, chronic obstructive pulmonary disease, aspirin use, and prior bleed/anemia. In the multivariate logistic regression model, aspirin ($p=0.02$) and prior bleed/anemia ($p<0.001$) were the only variables to remain statistically significant.

Conclusion: In our final model, only concomitant aspirin and prior major bleed/anemia were found to contribute significantly to the risk of major bleeding for patients receiving dabigatran or rivaroxaban. While the HASBLED score has been validated to predict risk of major bleeding in patients on warfarin with atrial fibrillation, our study provides evidence in a real-world cohort that it is not predictive of major bleeding for patients receiving dabigatran or rivaroxaban. With the increased utilization of these new anticoagulants in clinical practice, further studies exploring variables associated with risk of major bleeding are needed.

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6-033

Category: Cardiology / Anticoagulation

Title: Traceability of generic enoxaparin in active and passive surveillance systems implications for biosimilars pharmacovigilance

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Purpose: Sodium enoxaparin (Lovenox) is an injectable drug administered to mitigate the risk of thrombosis. In addition to Lovenox there are several marketed enoxaparin generics in the United States. Enoxaparin is associated with a rare, but potentially severe immune-related safety event, heparin-induced thrombocytopenia (HIT). Because it is an off-patent, injectable drug with immune related side effects this product class represents a useful case study to assess the ability of existing safety surveillance systems to monitor product-specific safety signals, and to identify findings which may be of relevance to future market entry of biosimilars in the United States.

Methods: We examined the capability to perform product-specific safety monitoring of branded and generic sodium enoxaparin based on data from claims databases as well as from spontaneous adverse event reports. Claims data for outpatient use of enoxaparin from January 2009 to June 2012 were compiled from a commercial payer database covering approximately 31.3 million lives and from a Medicare Supplemental database covering an additional 3.1 million lives. National Drug Codes (NDCs) were used to identify specific enoxaparin products dispensed, and the ICD-9-CM diagnosis codes were used to assess the incidence of HIT. An institutional claims database was also evaluated to determine if enoxaparin administration could be tracked at the product specific level. Spontaneous safety reports for enoxaparin as a primary suspect drug were examined in the FDA adverse event reporting system (AERS), covering the period from January 2008 to September 2012. The proportion of reports attributable to specific generic manufacturers after loss of market exclusivity of Lovenox in July 2010 was related to the generic volume market share of these products.

Results: Thrombocytopenia-related events were well tracked to individual products in the outpatient claims databases. The ability to track safety to the product level was due to the availability of diagnostic codes for HIT and of product-specific NDCs for the pharmacy dispensing channel. A potential limitation of this analysis is that some thrombocytopenia events may have been coded under hemorrhage related codes. In contrast, product-specific safety data could not be tracked in an institutional claims database due to the use of shared reimbursement codes for all versions of sodium enoxaparin. Generics accounted for approximately 50% of

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market share for sodium enoxaparin after loss of exclusivity, but only 5% of the enoxaparin safety reports in AERS were linked to specific generic manufacturers. The remaining reports either used the brand name Lovenox (63%) or used the generic name but were not linked to a generic manufacturer (32%). Assuming that specific safety risks were similarly likely among the brand and generic products, this result suggests that most safety reports for generic drugs were not attributed to the relevant manufacturer in AERS. A limitation of this approach is that additional identifiers potentially provided by reporters are not included in AERS (e.g., manufacturer name or NDC).

Conclusion: These results indicate that the current pharmacovigilance system is sub-optimal at attributing safety events to specific manufacturers. Additional studies may be needed, but the results are supportive of policy measures to improve the fidelity of pharmacovigilance in the era of biosimilars. Recommendations include assigning each biosimilar product a unique reimbursement code and to track biological products within medical records by using distinct names (e.g., brand or non-proprietary). Pharmacists and other reporters who submit safety event reports should include product specific identifiers and recognize that optimal pharmacovigilance will rely on the establishment of institutional processes that account for the aforementioned challenges.

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6-034

Category: Cardiology / Anticoagulation

Title: Safety improvement via risk stratified anticoagulant use for percutaneous coronary intervention: pilot study and future implementation in the largest not-for-profit health system

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Purpose: Percutaneous coronary intervention (PCI) is the most commonly performed therapeutic cardiac procedure. Procedural anticoagulant therapy plays a critical role in achieving positive patient care outcome. However, bleeding is the most common complication in patients undergoing PCI. Guidelines and numerous clinical trials have demonstrated advantages and disadvantages of each therapy option. We describe development of a bleeding risk stratified algorithm for specific anticoagulant use and associated outcomes.

Methods: A multi-disciplinary group comprised of interventional cardiologists evaluated guidelines and all pertinent literature and developed a treatment algorithm for specific risk. The algorithm required unfractionated heparin(UFH)for low risk and bivalirudin for high risk patients. GIIa/IIIb agent, such as Eptifibatide was reserved for specific situations only. The expert group recommended a pilot study on the effectiveness of the algorithm in our largest PCI provider among our 113 hospital health system. 235 patients were enrolled in the study over 3-month period and each patient was evaluated for bleeding risk.All patients were pre-treated with clopidrogel or prasugrel or ticagrelor. low risk patients received heparin. Bivalirudin or radial access was used in patients with immediate or high blood risk.2,533 consecutive PCIs from previous year served as the control.

Results: Only one case (0.38%) with major bleed was reported during the study against 24 cases (9.5%) in the control. Bivalirudin was more frequently used in high risk patients

Conclusion: An associated 67% relative risk reduction in PCI-associated major bleeding was observed in the study period.Prompting to assess bleeding risk during PCI appeared to increase appropriate use of bivalirudin.We are in process of planning to implement bleeding risk stratified anticoagulant therapy systemwide.

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6-035

Category: Cardiology / Anticoagulation

Title: Evaluation of the adherence to the discharge management for secondary prevention of acute coronary syndrome in Lebanon

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Purpose: Acute coronary syndrome (ACS), including unstable angina, non-ST, and ST elevation myocardial infarction, remains a major cause of morbidity and mortality worldwide. Despite the acute management of ACS, patients are still at risk for recurrent cardiovascular events, which necessitates the use of secondary prevention medications, including aspirin, thienopyridines, angiotensin converting enzyme inhibitors (ACEI) or angiotensin receptor blockers (ARBs), beta blockers (BB) or non-dihydropyridine calcium channel blockers (NDCCBs), and statins. Limited studies have been published in Lebanon to evaluate the adherence to the combination evidence based medical therapies post ACS. The aim of this study is to determine the individual and collective prescription rates of the 5 key guideline recommended medications for secondary prevention of ACS after hospital discharge and the factors associated with non-adherence to the combination therapy.

Methods: The institutional review board approved this retrospective observational study which was conducted from February to May, 2014. A survey was developed to identify the demographics, co-morbidities, home medications, vital signs, labs, type of ACS, interventions performed, and discharge medications. Medical charts of 344 patients discharged from the cardiac care unit (CCU) after an admission for a suspected ACS, in 2 Lebanese hospitals, were screened. The inclusion criteria incorporated patients in the CCU, of both sexes, aged 18 years and above, admitted during the year 2013 with a diagnosis of ACS, and discharged alive. The only exclusion criterion was death during hospitalization. The pharmD candidate filled 48 variables that required an average of twenty four minutes for each patient. A chi square test was used to compare categorical variables. Logistic regression was performed to identify patient characteristics independently associated with the collective use of the aforementioned 5 evidence based agents. All statistical analysis were performed using SPSS version 20, and two-tailed p-values of less than 0.05 were considered to indicate statistical significance.

Results: The medical records of 200 patients who met the inclusion criteria were analyzed, whereby 33.5% were females and 66.5% males. The mean age was 60.3 years, with a standard deviation of 13.6, and a range between 23 and 92 years. Adherence to the discharge medications was identified based on the drugs dispensed during the last day of hospitalization. The primary end point was to assess the percentage of patients discharged on the 5 drug combination therapy.

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The secondary end point included the examination of the presence of a medical reason behind the non-adherence to any of the 5 key recommended medications. We also sought to evaluate patient characteristics associated with the collective use of these agents. At discharge, 95.5% of patients received aspirin, 89.5% thienopyridines, 61.0% ACEI/ARBs, 75.5% BB/NDCCBs, 82.5% statins, and 40.0% the combination of all 5 agents. Only 28.33% of the sixty percent of patients who were not adherent had a reasonable explanation. Non-adherence was explained by several reasons, among which were hypotension, bradycardia, hyperkalemia, decompensated heart failure, second degree heart block, active liver disease, gastrointestinal bleeding, and allergy. Co-morbidities, including hypertension (OR, 1.879; 95% CI, 1.027 to 3.441; P, 0.041) and dyslipidemia (OR, 2.402; 95% CI, 1.177 to 4.902; P, 0.016) were associated with more adherence to the 5 drug combination therapy.

Conclusion: Pharmacological secondary prevention in patients after ACS has contributed substantially to reductions in cardiovascular morbidity and mortality. Despite the strong and unequivocal benefits of these agents, there is still a considerable adherence gap and opportunity for improvement. The role of the clinical pharmacist remains crucial in ensuring the adherence to the appropriate medications after ACS so that, the best patient outcomes are maintained.

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6-036

Category: Cardiology / Anticoagulation

Title: Assessment of the appropriate utilization of unfractionated heparin in a coronary care unit

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Purpose: Unfractionated heparin (UH) is a high-risk drug. It has a narrow therapeutic window with high inter- and intra-patient variability necessitating careful laboratory monitoring and dose adjustment to ensure proper antithrombotic protection while minimizing the bleeding risk. The objective of our study was to assess the appropriate use of UH in the coronary care unit (CCU) of a tertiary care hospital in Beirut, Lebanon.

Methods: In this retrospective observational study, we reviewed the medical charts of all patients admitted to the CCU and received UH between April 1 and May 30, 2014. We assessed the indication for UH, dosage, monitoring parameters, and possible side effects.

Results: Sixty two patients were included in the study; 58% received UH for DVT prophylaxis, 28% for acute coronary syndrome (ACS), and 14% for atrial fibrillation (AF). All patients received an appropriate dosing for DVT prophylaxis; 5000 units subcutaneously twice daily. In 27 patients receiving UH for AF or ACS, weight was documented in only 7. All patients received a loading dose of 4000 units except for two who received 3000 units, one of which weighed 51 kg while the other had an unknown weight. One patient with an unknown weight received a loading dose of 6000 units. The maintenance dose was correct in 4 patients of those with known weight while it ranged between 700-1300 unit/hour in those with unknown weight. aPTT was not checked every 6 hours in all patients during the first 24 hours of UH infusion. Only 5 patients had a therapeutic aPTT during the first 24 hours of heparin infusion. 60 sub-therapeutic and 17 supra-therapeutic aPTT readings were documented while on UH. Three patients had a drop in hemoglobin > 2 g/dL. Four patients had a drop in platelet count below 150,000/mm³, one of which had a drop in count below 100,000/mm³. Fecal occult blood test was ordered in 4 patients only.

Conclusion: The use of UH was inappropriate in the majority of patients in the CCU who are treated for ACS or AF. Documenting patients weight and abiding by heparin protocol is strongly recommended.

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6-037

Category: Cardiology / Anticoagulation

Title: Hypertension prevalence, awareness, and treatment in a sample of Lebanese population: a prospective study

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Purpose: Hypertension is called "the silent killer since it is one of the causes of premature morbidity and mortality world-wide. Earlier detection of hypertension reduces the burden of cardiovascular diseases. Accordingly, this study describes the incidence, awareness and treatment of hypertension in a sample of Lebanese population.

Methods: Lebanese citizens aged 18 years and above who visited a charitable clinic in May 2012 were screened for hypertension by measuring their blood pressure and reviewing their medical history. After obtaining an informed consent, a personal interview was held to collect the past medical history, past drug therapy, and compliance.

Results: Six hundred fifty seven patients were screened. Based on the blood pressure recorded and the past medical history obtained from the patients, 67.7% had hypertension of which 65% were aware of being hypertensive. The mean age of the studied sample was 58.12. Sixty percent were female and 40% were male. The total number of patients on medication was 240, of which only 58.8% were compliant. Out of the compliant patients only 60.3% had their blood pressure controlled on therapy. The percentage of patients taking Angiotensin Converting Enzyme Inhibitor, -blocker, combination of 2, 3 and 4 different classes and unknown medications were 16.7%, 24.6%, 34.6%, 10.8%, 1.3% and 12% respectively. The incidence of smoking, caffeine, family history of hypertension, diabetes, dyslipidemia and CAD in the studied sample was 48.5%, 91.2%, 33%, 33%, 29.2% and 12.1% respectively. Physical activity is only detected in 12%.

Conclusion: This study has demonstrated a high incidence of hypertension in a Lebanese sample. A large number of patients were unaware of being hypertensive. Some are non-compliant, have several risk factors and do not practice adequate lifestyle. As a consequence, an awareness campaign should be made in all regions of Lebanon to explore and educate patients about hypertension.

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6-038

Category: Cardiology / Anticoagulation

Title: The analysis of pharmacy interventions in a multidisciplinary inpatient palliative care service for patients with advanced heart failure at a cardiovascular hospital in Japan

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Purpose: Despite advances in heart failure (HF) treatments, the number of HF patients continues to grow. Although palliative care for cancer is common, patients with HF still lack access to palliative care in Japan, and it may impact their quality of life. In September 2013, a multidisciplinary team consists of physicians, nurses, pharmacists, social workers, physical therapist, dietitian, and clinical psychotherapist started a palliative care service at National cerebral and cardiovascular center (NCVC). The purpose of this analysis was to review interventions since the team started consultations, and to develop strategies to improve the service with a focus on pharmacy interventions.

Methods: Investigational review board approved this analysis. Records of palliative care consultations from September 1, 2013 to April 30, 2014 were reviewed. During the study period, three pharmacists who shared responsibility for the palliative care service recorded pharmacy interventions during a team meeting. The team meets once a week to discuss care plans for referral patients in the multidisciplinary round. The following data was recorded: patient's name, age, sex, major diagnosis, reasons for consultation, interventions by the team, interventions by pharmacists, drug name, nature of pharmacy consult, and types of pharmacy interventions. The reasons for consultation were categorized into optimization of end stage HF symptoms such as pain and dyspnea, management of psychological and psychosocial issues, coordination of care with health care providers, spiritual support, ethical issues, advanced care planning, and grief care. The pharmacy interventions were categorized into following: dose and frequency, dose adjustment for renal or liver dysfunction, suggesting alternative treatment, adding prophylaxis medications of opioid-induced adverse reactions (ADR), opioid conversion, drug interactions, reporting ADR, and others. In addition, the data of history of medications, laboratory data, outcomes, and clinical progress notes was obtained by EMR. The characteristics of palliative care consultations and pharmacy interventions were analyzed.

Results: A total of 33 patients were consulted during the study period. Four patients were excluded from this analysis due to deaths before interventions or insufficient documentation to analyze. Of 29 patients included, 21 patients were male and 8 patients were female, and the mean age was 66.7 years. Ten patients (34.5%) had cardiomyopathy and four patients (13.8%) had

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valve diseases. The reasons for consultation were following: optimization of end stage HF symptoms (31.0%), pain control (24.1%), dyspnea (13.8%), spiritual support (13.8%), and others. The total number of pharmacy interventions was 34. Of 34, 32 (94.1%) were drug information provided to the team, and 2(5.9%) was a paperwork to get non-formulary medications. The types of interventions were renal dosing of pain medications (26.5%), adding prophylactic medications for opioid-induced ADR (17.6%), dose and frequency (14.7%), opioid conversions (14.7%), and others. Frequent medications consulted were opioids (52.9%), pregabalin (11.8%), and tramadol (8.8%). Two medication related problems identified were attending physicians started opioids without laxatives and antiemetics and the patients had symptoms of nausea and constipation although the palliative care team recommended the corresponding prophylaxis.

Conclusion: Majority of interventions by pharmacists were opioid related. Since palliative care pain management is complicated and two medication problems identified were also related to the opioid induced ADR management, we plan to develop opioid prescribing guidelines and implement a standard order set into the CPOE system for the next step.

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6-039

Category: Cardiology / Anticoagulation

Title: Prescribing patterns of antiulcer agents among adult patients on low dose aspirin at National Cerebral and Cardiovascular Center in Japan

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Purpose: Low dose aspirin (LDA) is widely used for coronary heart disease prevention; however, LDA increases the risk of gastrointestinal (GI) complications. National cerebral and cardiovascular center (NCVC) is a 640 bed hospital specialized in cardiovascular diseases. Risk of mortality from upper GI bleeding was reported high among patients with congestive heart failure, ischemic heart disease, and renal failure; therefore, it is crucial that physicians identify individual patients risk associated with LDA and provide appropriate ulcer prophylaxis. The objective of this study was to identify prescribing patterns of antiulcer agents among patients on LDA, and to appraise current ulcer prophylaxis strategies.

Methods: The Institutional review board approved this retrospective observational study. A retrospective chart review of patients receiving LDA treatment between July 1, 2013 and July 31, 2013 was conducted at NCVC in Japan. Patients older than 14 years old who received an inpatient order for LDA were included. The data collected by electric medical record was age, sex, allergy, a previous medication history, a previous GI event, major diagnosis, antiulcer agents prescribed, concurrent use of anticoagulants, antiplatelet agents, corticosteroids, and other NSAIDs. Although helicobacter pylori (*H.pylori*) infections are one of risk factors to increase the risk of NSAID-related GI complications, the laboratory data for *H.pylori* was not collected due to the lack of availability at NCVC. The primary outcome evaluated was the rate of concomitant use of antiulcer agents: proton pump inhibitors (PPI), histamine-2-receptor antagonists (H2RA), and misoprostol. The second outcome evaluated was each patients risk based on the number of risk factors for ulcer: age over 65 years, history of ulcer, concurrent use of anticoagulants, antiplatelet agents, corticosteroids, and other NSAIDs. If patients were on multiple medications with ulcer risk, we considered each medication as one risk factor.

Results: Among 1,346 hospitalized patients during the study period, 314 patients with LDA treatment were included in this study with mean age was 67.1 years and 72.6% was male. Of 314 patients, 250 patients (79.6%) were on antiulcer prophylaxis, and the antiulcer agents ordered were PPI (81.4%), H2RA (17.8%), and misoprostol (0.8%) respectively. Of 250 patients on antiulcer agents, 40.8% had previous GI events and 96.4% had more than 2 risk factors for ulcer. Whereas among 64 patients not on antiulcer agents during hospitalization, 21.8% had previous GI events and 85.9% had more than 2 risk factors. Thirty eight patients (60%) were on

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concurrent therapy with anticoagulants and antiplatelet agents, or other NSAIDs. Moreover, 50 (78.1%) of them had been on LDA treatment prior to admission.

Conclusion: This study showed that majority of patients not on ulcer prophylaxis had multiple risk factors, and most of them had been taking LDA prior to admission. It suggests that physicians tend to continue patients' home regimen without being aware of ulcer risks for patients who had been taking LDA at home. At NCVC, pharmacists perform medication reconciliation upon admission; therefore, we plan to educate both physicians and pharmacists about appropriate ulcer prophylaxis in order to improve our current practice.

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6-040

Category: Cardiology / Anticoagulation

Title: Predicting therapeutic response to warfarin treatment by measuring adherence to other chronic medications

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Purpose: Anticoagulation therapy with warfarin continues to present many challenges, requiring close clinical monitoring and heavy patient engagement. As alternative therapies continue to be released, predicting which patients are most likely to be successfully treated with warfarin could allow selecting prior to initiation of therapy which patients would best be candidates for warfarin and which ones may do better on an alternative therapy. The purpose of this study is to see if there is a predictive correlation between patients adherence to chronic medications for other conditions to therapy response to warfarin as measured by the time in therapeutic range (TTR).

Methods: The institutional review board approved this retrospective study of patients, 18 years and older, who were continuously enrolled at Kaiser Permanente Southern California (KPSC) between January 2012 and June 2013, who were on warfarin at least 6 months as of January 2013, and who received a select chronic medication for hypertension, diabetes, or hyperlipidemia between January 2012 and December 2012. Included patients had a diagnosis of atrial fibrillation and did not have a history of a thrombosis or mechanical heart valve or any active bleeding or thrombotic event during the study period. Adherence to select chronic medications was measured between January 2012 and December 2012 using the percent days covered methodology (PDC). Anticoagulation response was measured in a follow up period between January 2013 and June 2013 using the time in therapeutic range (TTR). The primary outcome was an average TTR comparison between patients adherent to their medications (as measured by PDC $\geq 80\%$) and those identified as non-adherent. An independent unpaired t-test was performed to measure the significance of the difference between the average TTR in each group. Baseline demographic comparisons were made between the two study groups.

Results: Among the 9,403 patients that met the criteria to be included in the study, 1,899 (20.2%) were not adherent as calculated by percent days covered to at least one drug classification (anti-hypertensives, diabetes, dyslipidemia). The average time in therapeutic range (TTR) amongst those patients adherent to all drug classifications they were on was 75.3% while amongst patients not adherent was 68.4% ($p < 0.001$). For anti-hypertensives alone ($n = 6,742$), the average TTR was 74.7% for adherent patients versus 67.6% for non-adherent patients ($p < 0.001$). For diabetes alone ($n = 1,781$), the TTR was 73.7% for adherent versus 68.9% for the non-adherent ($p = 0.003$). For dyslipidemia alone ($n = 7,834$), it was a TTR of 75.1% for adherent patients versus 67.1% for non-adherent patients ($p < 0.001$). Demographic differences between the

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two groups (adherent and non-adherent respectively) were, average age 76.0 years vs. 74.4 years ($p<0.001$), female gender 44.3% vs 43.0% ($p=0.313$), non-Hispanic white 72.3% vs 65.4% ($p<0.001$), Hispanic 11.7% vs 14.2% ($p<0.001$), non-Hispanic black 7.0% vs 10.9% ($p<0.001$), average number of concurrent meds 9.8 vs 10.0 ($p=0.327$), and Charlson Co-Morbidity Risk Score 7.8 vs 8.1 ($p<0.001$).

Conclusion: Adherence to other chronic medications does appear to predict therapeutic response to warfarin therapy as measured by time in therapeutic range. Creating a predictive model which includes adherence scores or risk factors for poor adherence to predict therapeutic response to warfarin may be possible. Further analysis and study will be required to build a comprehensive predictive model reflecting all risk factors for poor performance, but previous adherence scores alone may be used as a consideration in evaluating best candidates for warfarin treatment where alternatives exist.

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6-041

Category: Cardiology / Anticoagulation

Title: Decreasing rivaroxaban medication incidents by pharmacy staff education of the "LEARN" acronym

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Purpose: Rivaroxaban is a novel anticoagulant for which there is no specific monitoring criteria to evaluate under-coagulation or over-coagulation. Therefore, the prescriber should follow key guidelines and recommendations set forth by the manufacturer and clinical experts to ensure proper dosing. This can be a challenge due to the many factors that must be considered when ordering rivaroxaban. As a result many rivaroxaban orders required interventions due to improper prescribing. It was decided that Pharmacy Staff education would be conducted to educate the staff on rivaroxabans indications, dosing, side effects, and renal impairment guidelines in an effort to decrease medication incidents.

Methods: An acronym was developed by the clinical pharmacist using the most important monitoring criteria based on best practice guidelines, case reports and evidence based medicine worldwide. LEARN about rivaroxaban stands for: L- Liver disease (contraindicated in severe liver insufficiency) E- Evening meal; taking with evening meal enhances absorption in doses greater than 15mg A- Anticoagulants; rivaroxaban is an anticoagulant and all other anticoagulants must be discontinued after initializing rivaroxaban. R- Renal Function- Every indication has a dose which may need to be renally adjusted. Check creatinine clearance daily. N- Numerous Indications, numerous dosages The "LEARN" acronym was used to educate the pharmacy staff on rivaroxaban's prescribing guidelines. To assist and reinforce the LEARN acronym, the electronic drug surveillance system Senti7 is utilized to identify patients receiving rivaroxaban. The patients labs, profiles and clinical condition were monitored daily in accordance with the facility's anticoagulation policy.

Results: The LEARN acronym was rolled out as a pharmacy staff in-service in June 2012, with a post competency test to the pharmacists. Initial results after rolling out the LEARN initiative in the second quarter of 2012 through the first quarter of 2013 , showed 8.5% (3/35) of rivaroxaban orders resulted in medication incidents. However starting second quarter of 2013 through third quarter of 2013, as the numbers of orders of rivaroxaban increased, there was an increase in the number of medication incidents to 31.7% (13/41). This resulted in the re education of the staff. After re education, the number of medication incidents in the fourth quarter of 2013 through the first quarter of 2014 decreased to 21.8% (12/55).

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Conclusion: A simple acronym used in pharmacy staff education and competency test for the monitoring of rivaroxaban may decrease medication incidents and promote safer prescribing for rivaroxaban.

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6-042

Category: Cardiology / Anticoagulation

Title: Ondansetron induced QTc prolongation

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Case Report

Purpose: A 70 year old female presented to the hospital for right upper quadrant pain, and underwent an elective cholecystectomy for acute cholecystitis and cholelithiasis. Her past medical history included hypertension, diabetes mellitus, hyperlipidemia, atrial fibrillation (on anticoagulation). She was on the following medications prior to admission: diphenhydramine, warfarin, dofetilide, metoprolol, cholecalciferol, baclofen, metformin, brimatoprost eye drops, bimonidine eye drops, dorzolamide-timolol eye drops, and simethicone. All of her home meds were continued, with the exception of warfarin. Once the bilirubin stabilized she was taken to the operating room had had a laproscopic cholecystectomy. All pre-operative medications were continued, including dofetilide. On post-operative day one, the patient received her morning dose of medications as usual (including dofetilide). Approximately three hours after she received her dofetilide, she did receive ondansetron 4 milligrams intravenous push for complaints of nausea. By 15:48, it was documented that the patient was having runs of non-sustained ventricular tachycardia that were asymptomatic. At EKG was done at 16:16 and was read as non-sustained ventricular tachycardia, a QTc interval of 639 milliseconds. The patient received a magnesium sulfate 2 grams by intravenous bolus. At 18:07, she continued to have runs of non-sustained ventricular tachycardia, and the order was entered to discontinue both metoprolol and dofetilide (she at this point had only received her morning dose of these medications). At 18:50 the patient went into a ventricular tachycardia cardiac arrest. She immediately received compressions for two minutes, followed by a defibrillation of 150 joules, which resulted in the return of spontaneous circulation, breathing, and consciousness. At this point she was transferred from the regular medical floor to the coronary care unit, where she continued to have runs of non-sustained ventricular tachycardia. An EKG was done and the QTc interval was 449 milliseconds. Lidocaine was started (allergy to amiodarone) at 19:30, however at 20:45 she had another cardiac arrest. She was noted to be in a coarse ventricular fibrillation with loss of pulse. Compressions were started immediately, and prior to defibrillation, it was noted that she had return of spontaneous circulation. From that point on the patient remained in normal sinus rhythm with occasional premature atrial contractions and occasional premature ventricular contractions. Dofetilide is one of the anti-arrhythmics that is most commonly associated with QTc prolongation and the development of Torsades de pointes. Its use with other medications that cause QT prolongation requires providers to really consider the risk of QTc prolongation in each individual patient. In our case, the patient received one 4 milligram dose of ondansetron. The QTc prolongation of ondansetron is dose related, and generally not considered a contraindication until doses in excess of 16 milligrams are used. While our patient never experienced torsades de pointes, she did have an increasing QTc interval in about 4 hours in addition to episodes of ventricular tachycardia. This is likely due to the patient receiving a single

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dose of ondansetron 4 mg in addition to her usual home medication dofetilide. Since this patient experience, health care providers at our institution are more judicious in using any doses of ondansetron in patients on dofetilide.

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6-043

Category: Cardiology / Anticoagulation

Title: Comparing the impact of two omega-3 fatty acid products on hemoglobin A1c values

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Purpose: Elevated blood hemoglobin A1c values (>5.7%) are associated with increased incidence of diabetes and tend to correspond to worsening cholesterol parameters in patients lipid profiles. Some studies suggest certain statins, the most commonly used class of medications to treat hyperlipidemia, may significantly increase hemoglobin A1c values. Literature is controversial as to whether supplementation with omega-3 fatty acid products is also associated with increased hemoglobin A1c values. Therefore, the purpose of this study was to assess the impact of an over-the-counter (krill oil) and a prescription omega-3 fatty acid preparation on hemoglobin A1c values.

Methods: A total of 47 patients in a private cardiologist's clinic had two blood samples drawn to evaluate hemoglobin A1c levels on different dates within a one year period; these dates represent the time before and after supplementation with an over-the-counter (n=16) or commercial (n=31) omega-3 fatty acid preparation. All patients had hemoglobin A1c values determined at least one month after the first value was drawn. Approximately 51% of patients (n=24) had a previous diabetes diagnosis and 72% were taking statins (n=34) at the time both laboratory samples were drawn. Data were then analyzed retrospectively via General Linear Model-Repeated Measures using a full factorial model involving time, whether patients had a previous diabetes diagnosis, and impact of each fatty acid product on hemoglobin A1c levels. A second model investigated interactions of time, diabetes diagnosis, and statin use on hemoglobin A1c levels.

Results: As expected, patients diagnosed with diabetes had higher ($P<0.001$) hemoglobin A1c values as compared to those without diabetes (7.6 versus 5.7%). A numerical trend ($P=0.11$) for a two-way interaction between time and fatty acid product was observed, with patients taking krill oil having a larger increase in hemoglobin A1c values after supplementation (7.0 versus 6.6%) as compared to those taking the prescription product (6.5 versus 6.5%). Similarly, this increase in hemoglobin A1c values was most evident (three-way interaction; $P=0.23$) in diabetic patients after taking krill oil (8.0 versus 7.3%) compared to those taking the prescription product (7.4 versus 7.5%). Results from the second statistical model suggest patients taking statins compared to those not taking statins had numerically higher hemoglobin A1c values (6.8 versus 6.1%) ($P=0.174$), regardless of which type of omega-3 fatty acid product they were taking. However, no interactions were found when evaluating hemoglobin A1c values in patients taking statins with time after fatty acid supplementation or diabetes diagnosis.

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Conclusion: The over-the-counter omega-3 product showed a trend toward increasing hemoglobin A1c values, including those patients with a previous history of diabetes. Patients taking statins had numerically higher hemoglobin A1c vales, which is consistent with previously published literature. Larger studies are warranted to confirm this data, especially in those with a history of diabetes taking krill oil.

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6-044

Category: Cardiology / Anticoagulation

Title: Pharmacist-managed inpatient anticoagulation service quality assurance analysis

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Purpose: In 2012, a community teaching hospital established a referral based anticoagulation service where pharmacists manage warfarin therapy. Based on anecdotal feedback, prescribers report that the approved protocol may be too conservative leading to reduced time in therapeutic window and more held doses. Pharmacists report that the patients referred to the service are of higher complexity. The intent of this quality assurance analysis was to use the Charlson Index (CI) to compare the comorbidities between the pharmacist-managed patients with the prescriber-managed patients and to determine if the dosing protocol needs to be revised.

Methods: This study is a retrospective chart review, which has been submitted to Institutional Review Board. All patients from September 2013 through April 2014 referred to pharmacist-managed anticoagulation service and a random sampling of prescriber-managed patients were reviewed. Data extracted from the electronic medical record included gender, age, indication for anticoagulation, comorbidities that were used to calculate the CI, number of hospital encounters in the previous year, length of stay (LOS), time in therapeutic window (TTW), average daily dose of warfarin, frequency of held doses, international normalized ratio (INR) at admission and INR at discharge.

Results: A total of 250 patients were reviewed, with 125 patients in the pharmacist-managed group and 125 patients in the prescriber-managed group. Overall the average age of the patients reviewed was 70 years old with 58% being female. The most frequent indication for warfarin was stroke prevention for patients with atrial fibrillation with 63% in the pharmacist-managed group and 71% in the prescriber-managed group. There was no difference in the median CI between the two groups, with the pharmacist-managed and prescriber-managed group both having a median CI of 7. The TTW for the pharmacist-managed group was 26% while the prescriber-managed group was 33%. The average daily dose for the pharmacist-managed group was 5 mg while the prescriber-managed average dose was 4.5 mg. The median number of held doses was 1 and 0 for the pharmacist-managed group and the prescriber-managed group, respectively. The average LOS was 7.5 days for the pharmacist-managed group and 4.8 for the prescriber-managed group.

Conclusion: Based on the CI, there was no difference in complexity between the pharmacist-managed group and the prescriber-managed group, therefore disproving the pharmacists' perception that patients referred are more complex. Despite the patients in the pharmacist-managed group receiving a higher average daily dose when compared to the prescriber-managed

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group, TTW was less in the pharmacist-managed group, and more doses were held. The hypothesis that the current protocol is too conservative maybe true based on this data and the protocol will be revised to reduce the number of held doses and increase the TTW.

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6-046

Category: Clinical Service Management

Title: Pharmacist-led transition of care program for patients discharged from a community hospital

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Purpose: Identifying ways to reduce 30-day readmissions is a quality of care initiative in hospitals around the country. Improving patient understanding of medications at discharge has been recognized as a potential opportunity to reduce avoidable readmissions. Pharmacists are uniquely qualified to educate and coach patients on safe medication use and disease state management. This project was designed to decrease readmissions by utilizing pharmacist expertise during the discharge process.

Methods: In order to demonstrate proof of concept, this project was piloted on a medical-surgical floor with a historically high acuity level. Using the LACE tool, patients designated as high risk for readmission were targeted to receive discharge counseling by a pharmacist. The LACE Index Scoring Tool is a validated tool that places a predictive value on readmission or death in the 30 days following discharge. Once physician reconciliation of discharge medications was performed, a pharmacist would review these orders for discrepancies and then visit the patient. The pharmacist was responsible for clarifying medication regimens, reviewing indications, directions, and potential adverse effects, screening for adherence barriers, and counseling. After the medication list was verified by the pharmacist, the electronic medical record was updated and the patient was given two copies of their medication list along with educational handouts for new medications.

Results: The primary objective was to show a reduction in 30-day readmissions. Historic readmission rate for fiscal year 2013 for all patients discharged from the medical-surgical floor used in the study was 16.9%. Historic hospital readmission rate is 12.5%. The number of high-risk patients who received counseling by a pharmacist was 139. A total of 14 (10.1%) patients included in the study were readmitted within 30 days of discharge. Secondary objectives included adverse drug event prevention and establishment of a discharge medication reconciliation service. Pharmacists made interventions in 48 (34.5%) patients and prevented 88 potentially harmful ADEs. The pilot project has successfully evolved into a discharge pharmacist service provided to two of the hospital medical-surgical floors five days a week. Plans to expand services further are currently in progress.

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Conclusion: A discharge medication reconciliation service provided by a pharmacist is one way to reduce 30-day readmissions. We were able to successfully establish a discharge medication reconciliation service on a medical-surgical floor and show a decrease in 30-day readmission rates for high risk patients. Adding pharmacist services at discharge to other proven methods of reducing 30-day readmissions should become standard practice within health systems across the country.

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6-047

Category: Clinical Service Management

Title: Quality, productivity and economic results of a metered dose inhaler to nebulizer interchange in a large, regional referral medical center

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Purpose: Patients with chronic respiratory conditions such as chronic obstructive pulmonary disease (COPD) are commonly managed as outpatients with metered dose inhaler (MDI) therapy. When these patients are hospitalized nebulized therapy is often added resulting in therapeutic duplication. An initiative to interchange all inhaled medications to nebulizer was implemented at a 541 bed regional referral medical center in 2013. The goals of the initiative were to 1) provide safe, effective therapy; 2) reduce duplicate inhaled therapies; 3) decrease waste of unused MDI canisters; 4) streamline the hospital formulary and 5) track outcomes.

Methods: Prior to implementation, support for the initiative was obtained from physician specialists, members of the Pharmacy and Therapeutics committee, Medical Executive committee, and hospital administration. The plan/do/study/act (PDSA) model for continuous improvement was used. A multidisciplinary team (physicians, pharmacists, respiratory therapists and nursing) developed an interchange guide and proactively identified challenges that may arise and strategies to overcome them during the implementation of the interchange. Review and education of the initiative occurred for prescribers, nurses, pharmacists and respiratory therapists, messaging and prompts were developed in the computer system to assist in decision support. In October 2013, the initiative was implemented and respiratory therapists continued to administer all inhaled medications. To monitor progress, analytics programs were used to review and present concurrent utilization and cost outcomes monthly to the Pharmacy and Therapeutics and the Medical Executive Committees. Number of respiratory treatments, respiratory therapy (RT) work load statistics, average length of stay (ALOS) and 30 day readmission rates for COPD, patient satisfaction, and number and cost of formulary medications were measured and compared for the time period of October 2013 through March 2014 versus October 2012 through March 2013.

Results: During the first 6 months of the initiative, the total number of respiratory treatments decreased by 9 percent (93,285 treatments given October 2012 through March 2013 as compared to 84,735 treatments given October 2013 through March 2014). This change was attributed to a decrease in therapeutic duplications of inhaled medications. There was no significant change in total RT workload stats per patient day comparing Q4-Q1 2012-2013 (2.7) with Q4-Q1 2013-2014 (2.5). RT workload targets were adjusted following conversion to maintain a neutral labor budget. Comparing Q4-Q1 2012-2013 with Q4-Q1 2013-2014, productivity remained similar for

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the two periods at 116% and 110% respectively. Patient satisfaction based on observation from respiratory therapists improved with the interchange to nebulized medications. For patients with a diagnosis of COPD, ALOS and 30 day readmissions remained relatively stable indicating the change in therapy did not adversely affect patient outcomes. (ALOS of 5.3 days, 30 day readmission rate of 11 percent [September 2012 through March 2013] versus ALOS of 5.1 days 30 day readmission rate of 12 percent [September 2013 through March 2014]). Number of formulary medications was reduced from 15 to 3 and MDI waste after implementation was eliminated. Respiratory medication purchases were decreased by \$196,533 or 59% in the first 6 months of the initiative.

Conclusion: By collaboratively working with other departments within the medical center, it is possible to successfully implement a respiratory medication initiative that is based on safety, efficacy and cost effectiveness. Utilizing analytics tools that focus on quality, workload and economic data, the medical center was able to quantify and monitor progress on outcomes with objective data. The plan, do, study, act was successful in the continuous improvement of the initiative.

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6-048

Category: Clinical Service Management

Title: Implementation of pharmacist refill authorization service in an academic medical center

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Purpose: Community pharmacies routinely send prescription refill requests on behalf of patients, but significant wait time in response from the outpatient clinics was experienced by these pharmacies and patients, especially those responses from academic medical centers. The long refill turnaround time can pose risks for patients health, diminish quality of care and also negatively impact patient adherence. This case describes the methods by which a novel pharmacist refill authorization service was implemented in order to improve response time for refill requests.

Methods: A pharmacist with advanced training (residency) wrote a protocol which would allow pharmacists to authorize refills for providers at the medical center. This protocol specified refill eligibility criteria for each drug class including lab monitoring, adherence, and adverse drug reactions assessment. The protocol was reviewed by each specialty providers throughout the medical center, and was approved by the pharmacy and therapeutics committee and the medical executive committee. Based on this protocol, pharmacists assigned to this service were responsible for reviewing patients electronic medical records and authorize refills if appropriate. They were also responsible for recommending any additional interventions to the provider based on pharmacists review of patients current drug therapy.

Results: Pharmacist refill authorization service was tasked with addressing faxed refill requests. The baseline turnaround time for faxed requests was 7-10 business days. After the implementation of the new service, the faxed refill request response time was reduced to an average of 48 hours. The improvement seen in the refill response time has led to expansion of the protocol to include additional therapeutic drug classes, 90 day supply authorization, and therapeutic substitution. Patients saw additional benefits such as counseling by pharmacists, review of current drug therapies in between clinic appointments, and additional clinic scheduling opportunities.

Conclusion: Implementation of a pharmacist refill authorization service can reduce refill response time, provide patient with additional benefits between clinic appointments, and expand scope of practice for pharmacists in the ambulatory setting.

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Professional Poster Abstract

6-049

Category: Clinical Service Management

Title: Impact of inpatient inhaler education by pharmacy students

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Purpose: Education of patients by providers is vital; however, added significance is imparted when that education involves devices, e.g., inhalers or syringes. Ensuring appropriate inhaler use became a focus for the pharmacy department of this urban safety net hospital; a preliminary study identified opportunities for improvement in inhaler use by inpatients and the nurses monitoring dose administration. Importantly, appropriate use of inhalers spans the transitions of care. Recently, a component of the pharmacy's patient education program incorporated inhaler instruction. To facilitate provision of education by pharmacy, advanced pharmacy practice experiential (APPE) students were engaged in the process, which involves placebo inhalers.

Methods: To measure the impact and effectiveness of the instructional sessions for inpatients with chronic disease, the student measured the patients baseline knowledge of and skill in inhaler use; then, immediately within the same session, the patient was requested to teach back the process. Finally, 24 to 72 hours after the initial instructional session, the patient was again requested to teach back the process: a post-test. To facilitate comparison of patient scores, steps in the administration of each inhaler were totaled, respectively, and the patient was scored on the number of steps appropriately executed. In all cases, the student identified and counseled the patient regarding improperly executed steps. The design was to follow-up on all patients by also conducting a post-test; however, given the logistical limitations of team availability during off-hours and unexpected discharges, capture of all patients included in the initial sessions was not deemed plausible. All adult patients with chronic and hospital use of tiotropium inhalation powder, budesonide/formoterol inhalation aerosol, and albuterol inhaler were included in the study. The time period of measurement spanned 1-15-14 to 5-16-14.

Results: In total 276 patients were instructed and then asked to teach back; not all patients with inhalers were included due to logistical reasons, commonly unavailability of unit-based pharmacist-student teams during off hours. Of these 276 patients, 37 received tiotropium (9 step process), 117 budesonide/formoterol (8 step process) , and 122 albuterol (7 step process). Scores

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improved from baseline to the initial teach-back: 5.8 to 8.0 (of 9), 4.5 to 7.2 (of 8), and 4.1 to 6.7 (of 7), respectively. Of those patients with a post-test after a 24 to 72 hour delay, 14 tiotropium, 35 budesonide/formoterol, and 35 albuterol patients, the post-test scores were 7.2, 6.6, and 6.2, which represented 24.6%, 47.2%, and 50.0% improvement over baseline. Post-test scores did decrease somewhat over the initial teach-back: 9.9%, 8.1%, 7.9% reduction in scores for tiotropium, budesonide/formoterol, and albuterol. Focusing on the critical steps, e.g., repeat of the steps, as required for tiotropium to enable delivery of the full dose (2 puffs): of the 14 patients with post-tests, five patients missed that critical step at baseline, one in the initial teach back, and none in the post-test.

Conclusion: APPE students, as part of a clinical pharmaciststudent team, can make a positive impact on care, as demonstrated in the improved patient inhaler technique scores. Further need for patient education post discharge is demonstrated given that post-test scores still documented some inappropriate execution. Although causes of readmission are multi-factorial, readmission rates of adult chronic pulmonary diseases have decreased from the 2013 baseline to below expected rates for the months of January through March of 2014 with no other changes in the care of these patients. Potentially, re-admission was impacted by improved patient knowledge of and skill in inhaler use.

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6-050

Category: Clinical Service Management

Title: The Impact of a continuum of care resident pharmacist on heart failure readmissions and discharge instructions at a community hospital

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Purpose: .To examine the impact of a Continuum of Care Resident Pharmacist (CCRP) on 1) heart failure (HF) 30-day hospital readmissions and 2) compliance with Joint Commission Heart Failure core measure 1 (HF-1) at a community hospital.

Methods: .The Continuum of Care Network (CCN) led by a CCRP was established in August 2011. The CCRP followed CCN patients and prospectively collected data from August 2011 to December 2012. Thirty-day readmission rates for CCN HF patients vs. non-CCN HF patients were compared and analyzed. Joint Commission HF-1 compliance rates were retrospectively collected from January 2011 to June 2011 and compared to data after establishment of the CCN.

Results: .One hundred sixty-two CCN patients and 470 non-CCN patients were discharged with a diagnosis of HF from August 2011 to December 2012. CCN HF patients had a lower 30-day all-cause readmission rate compared to non-CCN HF patients (12% vs. 24%, respectively; P 0.005). In addition, HF-1 compliance rates improved from the 80th percentile to the 90th percentile after implementation of the CCN. The top three interventions performed by the CCRP were discharge counseling (74.1%), providing a MedActionPlan (68.5%), and resolving medication reconciliation discrepancies (64.8%).

Conclusion: .The study findings suggest that a CCRP contributed to lowered HF readmission rates and improved HF-1 compliance rates. Future randomized, controlled trials are needed to confirm these findings.

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6-051

Category: Critical Care

Title: Evaluation of implementing the pain, agitation, and delirium clinical practice guidelines

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Purpose: The 2013 pain, agitation, and delirium (PAD) guidelines provide an extensive summary of PAD interventions aimed at improving short- and long-term outcomes in Intensive Care Unit (ICU) patients. There is a greater emphasis on recognition and treatment of pain and delirium in critically ill patients and for minimizing the use of sedatives in this population. Literature suggests routine screening of patients for delirium results in higher number of delirious ICU patients being treated. This study evaluated effects of PAD guideline compliance and its outcomes in adult ICU patients.

Methods: This is an observational study that includes patients admitted to ICU and intubated for minimum of 48 hours. Pre-intervention data was collected from patients admitted from January 2013 to March 2013. Beginning from November 2013, physicians and nurses were provided in-services and educational seminars on the PAD guideline and its recommendations. Additionally, a protocol based new order set for PAD assessment was developed and implemented in Electronic Health Record. Post-intervention data were collected from February 2014 to April 2014. Primary outcomes to be assessed include drug utilization of analgesics (morphine, hydromorphone, and fentanyl), sedatives (Dexmedetomidine, propofol, lorazepam, and midazolam) and anti-delirium drugs (haloperidol or any antipsychotic drugs). Secondary outcomes include assessment of delirium, length of stay (LOS) in ICU and hospital, duration of mechanical ventilation and mortality.

Results: A total of 577 patients were evaluated: 322 for the pre-intervention group and 255 for the post-intervention group. Out of those, 497 patients were excluded from the analysis, as they did not meet the inclusion criteria. 40 patients qualified in each group with the inclusion criteria and were considered for further analysis. Propofol use was significantly increased from 3.5 days of continuous infusion per patient in pre group to 11.6 days in post group ($p=0.004$). Midazolam use was decreased in the post group (1.1 vs 0.5 days of continuous infusion per patient, $p=0.3$). There was no difference in the use of analgesics or antipsychotic drugs between two groups. While no patients were assessed for delirium in pre group, all patients were screened for delirium assessment in post group using CAM-ICU, out of which 80% patients were found to be delirium positive. LOS in ICU was significantly reduced from 17.2 days per patient in pre group to 12.5 days per patient in post group. ($p=0.02$). LOS in hospital was reduced in post group as well, from 23.2 days to 17.5 days, but it was not statistically significant. Duration of mechanical ventilation

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was reduced in post group, from 8.7 days to 5.8 days, which was reported to be statistically insignificant.

Conclusion: Implementation of PAD guidelines at Cleveland Clinic Florida led to improved compliance of delirium assessment using CAM-ICU, increased usage of non-benzodiazepines (i.e. propofol), trend towards reduced usage of benzodiazepine sedatives, reduced ICU and hospital LOS, reduced mechanical ventilation days and mortality. For future direction, delirium needs to be addressed in patients who were found to be CAM-ICU positive and secondary outcomes in patients treated for delirium would need to be assessed again.

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6-053

Category: Critical Care

Title: A multicenter evaluation of off label medication use and adverse drug reactions

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Purpose: Off label use of medications occurs frequently in the intensive care unit (ICU), resulting in over 36% of the prescribed medications being used off label. Unfortunately, the safety of medications for non-Food and Drug Administration (FDA) approved uses in the critically ill population remains unknown. The purpose of this study was to determine the incidence of adverse drug reactions (ADRs) associated with off label drug use and to evaluate off label drug use as a risk factor for the development of ADRs in an adult ICU patient population.

Methods: This investigation was a multi-center, prospective evaluation of all patients admitted to the medical intensive care unit at three academic medical centers. All administered medications were evaluated for FDA-approved or off label use. All patients were assessed daily for the development of an ADR through direct observance during patient care rounds and chart review. Three previously published ADR assessment instruments were used to determine the probability of the adverse reaction resulting from drug therapy. The severity of and the resultant harm from the ADR was also assessed. A Cox proportional hazard model was used to identify a set of covariates that influenced the rate of an ADR.

Results: A total of 1654 patient days (327 patients) and 16,391 medications were evaluated, with 48.01% of medications being used off label. One hundred and sixteen ADRs were identified that could be categorized dichotomously, with 56.03% and 43.97% being associated with FDA-approved and off label use, respectively. The number of ADRs per medications given, number of harmful ADRs, and the number of severe ADRs did not differ for medications used for FDA approved or off label use (0.74% vs 0.67%, $p = 0.336$; 33 vs. 31 events, $p=0.567$; 24 vs. 24 events, $p = 0.276$). Patient age, sex, the number of high risk medications received, the number of off label medications received and the SOFA score were included in the Cox proportional hazard model. It was found that the rate of ADR increases by 9% for every one unit increase in SOFA score (10.9; 95 % CI 1.04 to 1.16) but that the number of off label medications did not increase the rate of ADR.

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Conclusion: Off label use of medications frequently occurs in the ICU. The number of ADRs resulting from off label compared to FDA-approved medication use was not significantly different. Off label medication use was not found to be a risk factor for the development of ADRs in the ICU.

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6-054

Category: Critical Care

Title: Evaluation of the implementation of an intensive care unit pharmacist at a large community hospital

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Purpose: To evaluate the impact of a critical care pharmacist in the Intensive Care Unit (ICU) at Meritus Medical Center.

Methods: A critical care pharmacist is available in the ICU daily from 0700 to 1530 and participates in bedside multidisciplinary rounds. Data was collected from Senti 7 which included all of the pharmacists interventions from April 2013 to April 2014. This information was analyzed to assess the pharmacists impact on patient care and cost savings. Intervention types include therapeutic drug monitoring, anticoagulation monitoring, IV to PO conversion, medication reconciliation, antibiotic recommendations, assistance in codes/traumas, and patient and caregiver education.

Results: From April 2013 to April 2014, the critical care pharmacist documented 4,061 interventions which resulted in a total cost savings of \$362,908. The most significant interventions were in the categories of glycemic control (n=110), antibiotic recommendations (n=147), pharmacokinetic monitoring (n=429), anticoagulation monitoring (n=127), and drug interactions (n=102). The pharmacist had a goal of 3 patient educations daily and was able to provide a total of 626 educations to patients and/or caregivers. The pharmacist was also available to provide assistance in 39 traumas and codes in the ICU. One component of cost saving interventions was IV to PO conversions which resulted in 465 interventions with an estimated cost savings of \$23,715.

Conclusion: With the implementation of a clinical pharmacy service in the ICU at Meritus Medical Center, the pharmacist was able to make numerous interventions to provide optimal patient care. In the near future, the pharmacist plans to provide a survey to learn about other healthcare professionals perspective of having a critical care pharmacist in the ICU. Future goals are to provide in-services to the critical care staff, education to other pharmacists covering the ICU, and a proton pump inhibitor stewardship program.

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6-055

Category: Critical Care

Title: Impact of a critical care pharmacist on glycemic control in the intensive care unit at a large community hospital

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Purpose: To identify the impact of a pharmacist on glycemic management in the Intensive Care Unit (ICU) at Meritus Medical Center.

Methods: A retrospective chart review started in January 1, 2013 for patients in the ICU. At the beginning of each month, data is collected for the previous month and is continually being collected. Data collected includes blood glucose readings and number of pharmacist recommendations for glycemic control. The blood glucose readings were analyzed to determine the average blood glucose per month, and percentage of normoglycemic, hyperglycemic, and hypoglycemic readings. Normoglycemic is considered glucose readings between 70 to 180 mg/dL, hyperglycemic is defined as blood glucose readings >180 mg/dL, and hypoglycemic is defined as <70 mg/dL. The data was analyzed for two study groups of the control group (January to May 2013 where no ICU pharmacist provided recommendations) and pharmacist intervention group (January to May 2014).

Results: A dedicated critical care clinical pharmacist started working in the ICU in March 2013. In August 2013, the ICU pharmacist started to provide glycemic recommendations starting in August 2013 after development of a guideline for glycemic control in critical patients. There was a total of 98 pharmacist intervention for glycemic control from January to May 2014, compared to 0 in 2013 ($p = 0.005$). The total glucose readings from January to May 2013 were 11,115 vs. 8,622 glucose readings in January to May 2014. There was a significant increase in the percentage of normoglycemic readings (61.9% vs. 54.5%; $p = 0.008$) and lower percentage of hyperglycemic readings (36.5% vs. 43.8%, $p = 0.001$) with the pharmacist intervention group. There was a lower percentage of hypoglycemic readings (1.5% vs. 1.8%; $p = 0.2$) with the pharmacist intervention group. The average blood glucose in the pharmacist intervention group was 173.4 mg/dL compared to 187.5 mg/dL ($p = 0.07$) in the control group.

Conclusion: An ICU pharmacist providing glucose management recommendations provides a significant improvement in glucose management. To further improve glycemic control within the target goal range of 140-180 mg/dL, it is recommended to educate the intensivists on glycemic control, initiate glycemic recommendations upon admission, and educate all pharmacists staffing in the ICU when the primary clinical specialist is not present.

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6-056

Category: Drug Information

Title: Development of a quick reference guide for syringe driver drug compatibilities

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Purpose: Drug administration via syringe driver is safe and cost effective. A continuous subcutaneous (SC) infusion may provide symptom control for patients in the palliative care setting. Many parenteral formulations of drugs may be suitable for subcutaneous administration however evidence and clinical experience with their use is lacking. Information on the risk of physical and chemical incompatibility associated with the process of mixing medications is neither readily accessible nor easily interpretable for frontline staff. In 2012, our Medicines Information Service received 57 enquiries pertaining to compatibility of drugs prescribed for continuous subcutaneous infusion via syringe pump, reflecting the need for a local reference compatibility chart.

Methods: The Medicines Information (MI) Pharmacists initially retrieved and reviewed all previous MI enquiries relating to drug compatibility in syringe drivers. Available stability data on specific 2- and 3- drug combinations were researched using past MI enquiries and palliative care resources. The data was then compiled and used to develop a web-based compatibility chart for 2- and 3- drug combinations commonly prescribed in palliative care.

Results: Three continuous SC infusion 2- and 3- drug combination compatibility charts were developed. This web-based resource is readily accessible to all frontline medical, nursing and pharmacy staff via the hospital intranet.

Conclusion: The administration of continuous SC Infusions via syringe driver has become fundamental in symptom control management within the palliative care setting. It is anticipated that the web-based resource developed will enable frontline staff to readily access compatibility data information at the time of prescribing. Monitoring of MI queries will continue to direct updating the resource to reflect hospital practice.

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6-057

Category: Drug Information

Title: Development of guidance for the use of non-steroidal anti-inflammatory drugs (NSAIDs) in the Mater Misericordiae University Hospital

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Purpose: An European Medicine Agency (EMA) review demonstrated that the cardiovascular effects of systemic diclofenac are similar to those of cyclo-oxygenase type 2 (COX-II) inhibitors. The EMA recommend that diclofenac is contraindicated in patients with ischaemic heart disease; peripheral arterial disease; cerebrovascular disease; or congestive heart failure. Diclofenac was the NSAID of choice in our hospital, consequently a formulary review of diclofenac was required.

Methods: A full literature review was initially conducted to determine comparative safety data of NSAIDs. A review of all hospital formulary NSAIDs was then undertaken with respect to relative efficacy, and consideration of the gastrointestinal, renal and cardiovascular safety profile of each NSAID. Consequently, a prescribing guideline for the use of NSAIDs was developed and implemented.

Results: The Departments of Anaesthesia, Surgery and Pharmacy reached consensus to remove oral diclofenac from the Hospital Formulary. Ibuprofen was chosen as the oral NSAID of choice. Parenteral dexketoprofen was added as a parenteral NSAID formulary option. The decisions were endorsed by the hospital Drugs & Therapeutics Committee. Web-based prescribing guidance was developed to assist in the selection of an appropriate NSAID depending on gastrointestinal, cardiovascular or renal risk factors.

Conclusion: Oral diclofenac has been successfully removed from the hospital formulary. A web-based NSAID prescribing guideline has optimised safe use of systemic NSAIDs based on EMA recommendations and other risk factors for NSAID use.

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6-058

Category: Drug Information

Title: Perception and knowledge of medical apps between first, second, and third year student pharmacists

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Purpose: Medical apps are becoming an important resource for various healthcare professionals, including pharmacists. However, there is currently little to no data available on the utilization of medical apps by pharmacy students. The objectives of this project were to 1) characterize and assess first, second, and third year student pharmacists perceptions of skills in finding, evaluating, and using medical apps 2) evaluate the need for a medical apps education module throughout the pharmacy school curriculum.

Methods: First, second, and third year student pharmacists at The Ohio State University College of Pharmacy were surveyed to gauge students perceptions on individual skills in finding, evaluating, and using medical apps via a written survey conducted in-class during spring semester 2014. First year student pharmacists engaged in a workshop where they practiced evaluating medical apps and discussed their use in practice. These students completed a follow-up survey 2 weeks later to assess the impact of the workshop on their perceptions of medical apps. These pre and post-surveys included Likert-scale, open-ended, and multiple choice questions assessing students perception of skills in finding, evaluating, and using medical apps, number and type of apps installed and used regularly, where students learn about new apps, barriers to using mobile devices in pharmacy, and willingness to pay for pharmacy-related apps. The post-survey additionally evaluated student satisfaction and suggestions for improving the medical apps workshop. All survey responses were anonymous, with data analyzed in aggregate using descriptive statistics.

Results: Over 80% of students in all classes Agreed or Strongly Agreed medical apps are beneficial to pharmacy practice. However, students perceptions on finding, evaluating, and using medical apps differed, with 62% of 2nd year student pharmacists Agreeing or Strongly Agreeing with knowing how to evaluate medical apps versus 15% of 1st year students and 42% of 3rd year students. 87% of 2nd year students and 79% of 3rd year students Agreed or Strongly Agreed to knowing how to find medical apps compared to 44% of 1st year students. 85% of 2nd year students and 88% of 3rd year students Agreed or Strongly Agreed to knowing how to use medical apps to enhance patient care compared to 26% of 1st year students. After engaging in a medical apps education workshop, the percentage of first year students who Agreed or Strongly Agreed to knowing how to evaluate medical apps rose to 93%, knowledge of how to find

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medical apps rose to 95%, and knowledge of how to evaluate medical apps rose to 90%. Greater than 80% of students in all 3 classes Agreed or Strongly Agreed that mobile technology should be integrated into the pharmacy curriculum.

Conclusion: This study provides novel data on the use of medical apps by pharmacy students. While many students recognize the importance of mobile technology to the future of the pharmacy profession, the majority of students struggle with finding and assessing medical apps to provide better patient care. Data from 1st year students demonstrates the positive impact of a medical apps workshop imbedded within the pharmacy school curriculum.

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6-059

Category: Drug Information

Title: Impact of clinical pharmacist counseling on Lebanese university students antibiotics knowledge

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Purpose: Clinical pharmacists play an integral role in improving patient therapeutic knowledge. The awareness of the general public about the correct use of antibiotics is limited. This results in antibiotic misuse which contributes to the development of resistant strains of microorganisms, therapeutic failure, and increased healthcare costs. In Lebanon, antibiotic access is made easier by the unrestricted availability. The purpose of this study is to assess knowledge of Lebanese students in one university regarding antibiotics, and evaluate the role of the clinical pharmacist in achieving appropriate level of education before and after counseling.

Methods: This was a prospective, interventional, single center study conducted from February till May 2014. University undergraduate students were eligible for study enrolment. Excluded were those in the medical field. Baseline antibiotic knowledge was assessed according to a questionnaire filled by the participants where a specific score was assigned. Later on, verbal education about antibiotics was provided randomly for a chosen sample of the participants. The same questionnaire was refilled by the counseled participants and a second score was recorded. Each participant gave a written informed consent, and approval for this study was obtained from the institution review board of the university in question. The statistical test used was the paired sample students T-test and data was analyzed by the SPSS version 20. P value less than 0.05 was considered significant.

Results: A total of 735 patients were enrolled in this study with baseline age of 20.83 plus/minus 2.423 years (mean plus/minus Standard deviation SD), where 78.34 percent of the participants were living in urban areas and 21.66 percent in rural ones. 13 questions were asked where 1 point was given for each correct answer. 74.4 percent knew the definition of antibiotic, 45.7 percent were aware of its indication, and 48.4 percent recognized that overuse causes resistance. 24.8 percent of the students had null knowledge (zero points) and 0.3 percent had complete knowledge (13 points). From the participants, 102 were randomly enrolled in the counseling lecture. After the counseling lecture, the score changed from a mean of 4.76 plus/minus 3.502 to 11.09 plus/minus 1.888 (p-value less than 0.01).

Conclusion: This study demonstrated that there are misconceptions regarding antibiotics' uses and indications. Clinical pharmacist counseling is successful in improving patients knowledge about antibiotics. A positive impact of the pharmacist on achieving the goals was evident among

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all enrolled patients. Thus, pharmacists tasks are not only limited to the practice of medication dispensing, but also includes various responsibilities as enhancing patients drug facts. Finally, this survey highlights the importance of a unified strategy to aid in raising the awareness about antibiotic utilization.

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6-060

Category: Drug-Use Evaluation

Title: 4-factor prothrombin complex concentrates for reversal of warfarin in a large academic institution

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Purpose: The aim of this study is to describe the use of a (non-activated) 4-factor prothrombin complex concentrate (PCC) for the management of warfarin-related hemorrhages and for reversal of INR for patients requiring surgery.

Methods: Single-center retrospective chart review of patients who received 4-factor PCC in a 65,000-visit tertiary referral Emergency Department since the 4-factor PCC had been added to Formulary (July 2013). Patients on warfarin who had received 4-factor PCC to manage bleeding or reverse INR were included in the study. Patients who received 4-factor PCC for other indications were excluded. Adequate reversal of the INR was defined as an INR equal to or less than 1.3. Descriptive analysis was performed on the data collected.

Results: To date, only data for intracranial hemorrhages (ICH) have been analyzed. The following data pertain only to ICH. Thirty cases were identified over a 7 month period. Sixteen (53.3%) patients were admitted to an ICU and 5 (16.67%) patients were taken emergently to the operating room (OR). All patients received phytonadione (vitamin K) in conjunction with the 4-factor PCC; although doses were not always optimal. Fifteen (50%) patients also received fresh frozen plasma (FFP) prior to the administration of 4-factor PCC. The average dose of 4-factor PCC was 2,060 417 units. The administration of 4-factor PCC significantly decreased the post-treatment international normalized ratio (INR) (2.65 0.90 vs. 1.27 0.19, $p < 0.0001$). Twenty-seven patients had an INR drawn post 4-factor PCC administration. Four (14.8%) of the patients did not achieve adequate INR reversal. Three (10%) of the patients died while in the hospital. The majority of the patients (76.7%) were discharged to some other type of healthcare facility (e.g., long-term care, inpatient rehab, etc.) which included 6 patients who had initiated hospice care due to complications of ICH. Three (10%) patients were discharged home. Ninety-day mortality was 40%. No thrombotic complications were reported. Additional data regarding 4-factor PCC use for other types of bleed and in patients with elevated INR requiring emergent surgery will be presented.

Conclusion: The administration of 4-factor PCC significantly decreased the INR in patients presenting to the ED with an intracranial hemorrhage. Future studies are needed to evaluate

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additional clinical and economic outcomes associated with the administration of 4-factor PCC for management of warfarin-related hemorrhage and reversal of INR.

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6-061

Category: Drug-Use Evaluation

Title: Prescribing of proper needle length for patients using insulin in an outpatient institution: a medication use evaluation

Primary Author: Steven Sparkes; Email: stsparkespharmd@gmail.com

Purpose: Recent clinical data demonstrate that all patients injecting subcutaneous insulin should be using the shortest needles available. A study by Gibney et. al. showed skin thickness is similar in the majority of patients and is not correlated with obesity. The study also showed that shorter needles rarely result in accidental intramuscular injections. A study by Hirsch et. al. showed that shorter needles are less painful and have higher patient satisfaction with similar glycemic control compared with larger needles. Therefore, all patients using insulin should be prescribed 4 mm pen needles and 6 mm syringe needles, the shortest available.

Methods: All prescriptions written by our providers for pen needles and syringes between 1/1/13 and 12/31/13 were obtained from Medical Records. Duplicate prescriptions for the same patient were eliminated and if the same patient had different prescriptions, the most recent prescription was used for analysis. The common pen needle lengths currently available in the United States are 4 mm, 5 mm and 8 mm, and the percentage of prescriptions for each length were evaluated. The common syringe needle lengths available are 6 mm, 8 mm and 12.7 mm, and the percentage of prescriptions for each of these lengths were evaluated.

Results: The Medical Records query produced 49 prescriptions written for pen needles and 19 written for syringes (excluding duplicate prescriptions). The percentage of prescriptions for 4 mm, 5 mm and 8 mm were 6.2 percent, 32.6 percent and 61.2 percent, respectively. The percentage of prescriptions for 6 mm, 8 mm and 12.7 mm were zero percent, 58 percent and 42 percent, respectively.

Conclusion: The majority of prescriptions for both pen and syringe needles were inappropriate based on the most recent data mentioned in the purpose. According to the data discussed in the purpose, these practices can compromise both safety and effectiveness of insulin therapy as they can result in intramuscular injections more often than using shorter needles. The MUE results were presented to our Pharmacy and Therapeutics committee. It was also addressed in a monthly Prescribing Tip sent to all staff in the institution. Pharmacy will periodically conduct similar MUEs to assess the effectiveness of these measures.

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6-062

Category: Drug-Use Evaluation

Title: Evaluation of hospital length of stay for patients being treated with rivaroxaban compared to enoxaparin

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Purpose: As health care reform moves forward, cost is a major focus for all health systems and finding ways to decrease the cost of patient care, which includes length of stay (LOS), is becoming more important. It has been suggested that the use of rivaroxaban instead of enoxaparin bridged to warfarin can shorten a patients LOS for nonvalvular atrial fibrillation (NVAF), pulmonary embolism (PE), or deep vein thrombosis (DVT). The purpose of this study was to determine if a difference in LOS existed between patients treated with rivaroxaban and enoxaparin/warfarin for NVAF, PE, or DVT at a community hospital.

Methods: The Institutional Review Board has reviewed this protocol. Patients electronic medical records were retrospectively reviewed to identify those who had received rivaroxaban or enoxaparin between June 1, 2013 and October 4, 2013. Only those patients whose indication for rivaroxaban or enoxaparin was NVAF, PE, or DVT were included. The following data were collected for each patient: date of admission and discharge, anticoagulant used, dose of anticoagulant used, number of doses of anticoagulant given, indication for anticoagulant, use of warfarin prior to admission, use of rivaroxaban prior to admission, use of enoxaparin as a bridge to warfarin, primary diagnosis, gender, weight, serum creatinine, and age. The primary outcome was odds of LOS greater than 4 days, as this is the average LOS at the community hospital.

Results: A total of 318 subjects were included, 77.4% received enoxaparin and 22.6% received rivaroxaban. The mean age of the subjects was 68.8 years. Of the 318 subjects included, 60.1% received anticoagulation for NVAF, 17.9% for PE, 18.9% for DVT, and 3.1% for a DVT and PE. For all patients, the mean LOS was 5 days. Patients being given enoxaparin had an average LOS of 5.1 day and patients being given rivaroxaban had an average length of stay of 4.6 days. The multivariable analysis demonstrated that there was no difference in the odds of having a LOS greater than 4 days between patients prescribed rivaroxaban and enoxaparin ($p = 0.4$). The mean cost per patient per admission for treatment with enoxaparin was \$62.12 and for rivaroxaban the mean cost was \$23.40.

Conclusion: The results at this community hospital did not reflect those reported in previous studies, which indicated that patients treated with rivaroxaban had a LOS that was from 1 to 1.38 days shorter, depending upon indication, than those treated with low molecular weight heparin bridged to warfarin. This study showed that giving patients rivaroxaban over enoxaparin for NVAF, PE, or DVT, although less expensive from a drug acquisition standpoint, had no

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statistically significant impact on the odds of a patient having a LOS less than this community hospitals average.

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6-063

Category: Drug-Use Evaluation

Title: Evaluation of linezolid utilization at a large, non-teaching hospital

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Purpose: With increasing amounts of resistant bacteria it has become imperative to ensure proper stewardship of current antimicrobials. Linezolid, an oxazolidinone antibiotic which inhibits protein synthesis, has FDA approved indications for bacteremia, cellulitis, community-acquired pneumonia, diabetic foot ulcer, nosocomial pneumonia, pneumonia, sepsis, skin and skin structure infections, and vancomycin-resistant enterococci (VRE). The purpose of this drug utilization evaluation is to assess ordering patterns for linezolid at our facility which is a large, nonteaching (hospitalist-based) medical center. The review of ordering patterns will provide insights into potential areas of staff education or restriction of linezolid to ensure cost-effective utilization.

Methods: This retrospective cohort study enrolled inpatients with orders for linezolid from September 1st, 2013 through February 28th, 2014. Through retrospective chart review, and a predefined data collection form, adherence to local policies regarding the therapeutically appropriate utilization of linezolid was assessed. Individual, patient-level data, including: age, infection site, admit diagnosis, ordering physician, other antimicrobial agents, duration of therapy and patient outcome were collected through progress notes, laboratory values, and microbiology cultures and analyzed. Individual reviewers assessed therapeutic appropriateness based upon the following criteria: a positive culture for MRSA and documented failure to improve on or pro-longed course of vancomycin; positive culture for Vancomycin Resistant Enterococcus (VRE); history of MRSA or VRE infection; failure of alternative antibiotic regimens such as vancomycin.

Results: A total of 99 patients had inpatient orders for linezolid during the period studied. The average duration of overall antibiotic therapy was 10.4 days with a range of 1-37 days. The average duration of linezolid therapy was 5.0 days. Of the 99 patients, 28 (28.2%) had a positive MRSA culture and 15 had a positive VRE culture. The predefined appropriate use criteria were met in 42.4% of patient cases. Of those, 14 (33.3%) had a positive VRE cultures; 12 (28.6%) received vancomycin without clinical improvement; 7 (16.7%) had a vancomycin allergy; 7 (16.7%) had a history of VRE; and 2 (4.8%) were continuing previously prescribed regimens of linezolid. There were 57 (57.6%) patients who did not meet predefined appropriate use criteria. Of those patients: 66.6% had alternative therapeutic options available; and 33.3% had linezolid

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empirically initiated in the absence of documented MRSA or VRE history. Infectious disease physicians were responsible for 50 linezolid orders, with 23 of 50 (46%) meeting predefined criteria for appropriate use. The remaining 49 linezolid orders were placed by non-ID physicians, with 17 of 49 (35%) meeting predefined criteria for appropriate use.

Conclusion: Linezolid appears to be overused in cases in which a narrower spectrum agent may be appropriate. Linezolid is an expensive empiric agent with potentially serious adverse effects. Appropriate utilization of linezolid would result in improved antimicrobial stewardship, decreasing potential antibiotic resistance and utilizing less toxic antibiotics. Development and implementation of new criteria of use will produce substantial cost-savings to the institution and ultimately improve patient outcomes.

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6-064

Category: Drug-Use Evaluation

Title: Effects of colestimide on discharge of methotrexate in patients with cerebral malignant lymphoma

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Purpose: High dose methotrexate (MTX) is often used for chemotherapy against malignancies. Accelerating elimination of MTX when the concentration of MTX in the peripheral blood is lowered below the effective level against malignant cells is desirable. Because MTX is partly circulating in the enterohepatic circulation, colestimide (CM), an effective therapeutic medicine for hypercholesterolemia and an accelerator of bile acid discharge, may possibly accelerate the elimination of MTX. We examined the effects of co-administration of CM on the concentration of MTX in the peripheral blood of patients with cerebral malignant lymphoma.

Methods: Thirteen cases of cerebral malignant lymphoma which were treated with chemotherapy involving MTX with or without CM were selected retrospectively from records of Kagawa University Hospital from September 2011 to June 2014. The chemotherapies included high dose methotrexate (HD-MTX) and HD-MTX, cyclophosphamide, doxorubicin, vincristine, and prednisolone (M-CHOP), in all of which 3.5 g/m² MTX was administered. Oral administration of CM (3.0 g/day, for 7days) was started at 9 hours after the administration of MTX. The serum concentrations of MTX were measured by fluorescence polarization immunoassay using commercially available MTX-measuring kit (Methotrexate –IIEDynapack®, Abbot, Japan). We compared the numbers of cases with MTX concentrations less than 0.1 μM in patients with CM co-administration and in those without it at 48 and 72 hours after MTX administration.

Results: The cases with MTX-concentration less than 0.1 μM at 48 hours after MTX-administration was 4 in 7 cases (57%) with CM co-administration, whereas those without it was 1 in 6 cases (17%). At 72 hours after the first MTX administration, 7 in 7 cases (100%) with CM co-administration and 3 in 6 cases (50%) without it showed MTX-concentration less than 0.1 μM. When all courses of chemotherapy using MTX in the same patients are evaluated

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independently, 13 in 20 cases (65%) with CM co-administration and 7 in 22 cases (32%) without it at 48hours (significant difference, $p < 0.05$ by chi-square test for independence) and 22 in 22 cases (100%) with CM co-administration and 16 in 20 cases (80%) without CM co-administration at 72 hours showed MTX-concentration less than $0.1 \mu\text{M}$.

Conclusion: Co-administration of CM with MTX accelerated the reduction of MTX concentration in the peripheral blood. It is suggested that CM combines with MTX cycling in the enterohepatic circulation and promote reduction of MTX in the peripheral blood. Co-administration of CM with MTX can be a useful means to reduce harmful effects of MTX and keep motivation of patients to receive chemotherapy involving MTX.

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6-065

Category: Drug-Use Evaluation

Title: Retrospective analysis addressing the safety and efficacy of denosumab as a new treatment option for solid tumors with bone metastasis, a single institute experience

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Purpose: Bone metastases from different solid tumors are associated with substantial morbidity. Skeletal complications of bone metastases often referred to as skeletal related events (SREs), include pathological fracture, spinal cord compression, the need for surgical intervention or radiation therapy to treat symptomatic bone metastasis, and hypercalcemia. ASCO guidelines, recommend bisphosphonates and recently denosumab as bone directed therapy to prevent and delay the SREs. Denosumab, a fully human monoclonal antibody targeting RANKL, has different mechanism of action than the bisphosphonates. It has been introduced in tawam hospital formulary since January 2011. The aim of this study is to evaluate this novel agent in terms of efficacy and safety.

Methods: A retrospective observational chart review analysis was done to all oncology patients receiving denosumab 120 mg from January 2012 to June 2012. This study was approved by the institutional review board. Patient demographics, median duration of denosumab treatment, presence of renal impairment, the calcium supplementation during the treatment and the indication for which the denosumab was used were all documented. The incidence of hypocalcemia and other side effects were also reported

Results: The medical charts of 69 patients were reviewed. Forty-three were females. The primary diagnosis was breast cancer in 39 patients, prostate cancer in 8, and other solid tumors in 22. The reason for treatment was bone metastasis in 87% of the cases, osteopenia/osteoporosis in 10%, giant cell tumor in 1.5%, and hypercalcemia in 1.5%. The median duration of denosumab treatment was 40 weeks (ranging 8-80 wks). The occurrence of SREs was reported in 11 patients (18%). Those events included radiotherapy in 8 patients, cord compression in 2 and pathological fracture in one patient only. Denosumab was the first bone targeted therapy in 28 cases. Fifty six percent of those had some degree of renal impairment that was defined by a CrCl of <60ml/min while those who received denosumab as salvage therapy after Zoledronic acid were 32 cases. The reason for switching was: disease progression in 15 cases, renal impairment in 13, and in 4 patients denosumab was considered more convenient with concomitant oral chemo or hormonal therapy. The adverse events reported were; severe hypocalcemia (Ca <1.875 mmol/l) in 10 patients (16%). In 8/10 the calcium/vitamin D supplementation were prescribed but

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unfortunately the compliance was not reported. Osteonecrosis of the jaw (ONJ) was confirmed in one patient. Fortunately, she had complete resolution on conservative treatment

Conclusion: Denosumab is another effective option in preventing and delaying SREs, it is safe in renal impairment (although Denosumab 120 mg was not studied in patients with $\text{CrCl} < 30 \text{ ml/min}$, whenever it is used in such patients, close monitoring should be carried out). Calcium level should be checked routinely along with Calcium supplementation to maintain the normal Calcium values, and not to rely on the symptoms since the preexisting chemo toxicities and tumor complications may mimic and mask the hypocalcemia symptoms

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6-066

Category: Drug-Use Evaluation

Title: Antibiotic surgical prophylaxis in a large academic medical center

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Purpose: Preoperative antibiotic prophylaxis is a well vetted and widely accepted practice for reducing postoperative surgical site infections. The goal of preoperative antibiotic prophylaxis is to reach bactericidal concentrations at the level of the tissues and serum prior to surgical incision in an effort to maintain sterility of the surgical site. We set out to examine prescribing patterns of preoperative and postoperative antibiotics in our institution to determine if we are providing optimal patient care, as well as meeting The Joint Commissions National Hospital Inpatient Surgical Care Improvement Project (SCIP) Quality Measures.

Methods: A convenience sample of patients undergoing a surgical procedure at our institution were enrolled in our study in September, 2013 and again in April, 2014. Starting January, 2014 a new process in which pre-induction unit (PIU) nursing staff assumed responsibility for antibiotic prophylaxis compliance was initiated. To assess the impact of this process data was collected for comparison of patient age, sex, comorbid conditions, preoperative culture results, preoperative antibiotic regimens, prophylactic antibiotic agent, route, dose, and timing, surgical procedure, procedure and anesthesia timing, and duration of postoperative antibiotic use.

Results: A total of 46 surgical cases were reviewed. There was no significant difference between the 2013 and 2014 cohorts in mean patient age (47.3 vs 48.5 years, $p=0.78$), sex (50% vs. 54.5% female), surgical procedures, prophylactic antibiotic agent, positive preoperative cultures, or preoperative antibiotic regimens. We found no significant difference between the 2013 and 2014 cohorts with regards to the percentage of patients receiving the appropriate antibiotic (91.7% vs 86.4%, $p=0.56$), appropriate timing before incision (87.5% vs 90.9%, $p=0.71$), and appropriate time to discontinuation of prophylactic antibiotics (91.7% vs 91.0%, $p=0.93$). We did observe a significant improvement in the proportion of patients receiving an appropriate prophylactic antibiotic dose when comparing 2013 and 2014 cohorts (70.8% vs 95.5%, $p=0.03$). The composite compliance rate of all 4 endpoints (agent, dose, administration, and stop time) was significantly different between the 2013 and 2014 cohorts (50% vs 81.8%, $p=0.02$).

Conclusion: Implementation of a strategy in which PIU nursing staff are educated and empowered to ensure appropriate prophylactic antibiotics are administered prior to surgery significantly improved our compliance with SCIP core measures and the quality of care provided to our surgical patients. The incidence of underdosing of prophylactic antibiotics was significantly improved through extensive provider education and publication of our surgical prophylactic antibiotic guideline.

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6-067

Category: Drug-Use Evaluation

Title: Metformin medication management, an older medication review...are we dropping the ball?

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Purpose: To avoid potential risks associated with the popular drug metformin, individual patient data must be closely evaluated for potential contraindications. In patients with serum creatinine [SrCr] levels greater than or equal to 1.5mg/dL for males, 1.4mg/dL for females, or abnormal creatinine clearance, metformin is contraindicated. Metformin should also be temporarily discontinued in patients receiving intravascular iodinated contrast. The purpose of this review is to evaluate whether or not pharmacists are providing appropriate metformin therapy in an attempt to determine if older medications are being given the respect they deserve as it relates to the potential for negative outcomes.

Methods: Data was collected by retrospective chart review. Patients who received metformin from September 1 to November 30, 2013, were included. The evaluation targeted both male and female patients. Metformin use as it relates to indication for use, patient laboratory data, potential radiological contrast interventions during associated encounters, and pharmacist intervention were evaluated. Patients were identified via the CERNER system.

Results: Sixty five patients (31 male and 34 female) were included in the data analysis. Only two patients received metformin for a non-FDA approved, but generally accepted, indication (polycystic ovarian syndrome & metabolic syndrome). Two patients (3 percent) did not have a baseline SrCr drawn within 48 hours of the first administered dose of metformin. Six encounters (9 percent) had instances where the recorded SrCr was outside of recommended parameters. Three patients (5 percent) received iodinated contrast without interruption of their metformin therapy. Two of the three patients were discharged less than eight hours after their radiological exam and prior to having another SrCr drawn, which did not allow for an adequate assessment of the iodinated contrast's potential negative renal effects. The third patient did have a SrCr drawn approximately 21 hours after iodinated contrast was given, which showed an insignificant drop of 0.1mg/dL. In addition, it was discovered that no precautionary note was placed on the extended release metformin product, and that the warnings placed on the other metformin products were outdated. Of the 65 encounters, there were nine occasions for the verifying pharmacist to intervene to prevent inappropriate therapy. Of these opportunities, appropriate intervention occurred four times (44 percent).

Conclusion: Patients are receiving metformin appropriately in relation to approved or generally accepted indications. Providers need to be re-educated on the importance of ensuring that kidney function is assessed prior to, and throughout the duration of, metformin therapy. To reduce the risk of negative outcomes, additional steps must be taken to address the issue of patients receiving iodinated contrast without interruption of their metformin therapy. Cautionary

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statements placed on products need to be updated to reflect current guidelines. Finally, this research may be representative of other older medications with specific contraindications that should be reviewed to uncover opportunities for process improvements.

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6-068

Category: Drug-Use Evaluation

Title: Clinical impact of antibiotics on anticoagulation ability in patients receiving warfarin

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Purpose: Several concomitant antibiotics cause the excessive anticoagulation in patients receiving warfarin. The potential mechanisms include the disruption of vitamin K synthesis, metabolic inhibition of cytochrome P450, and reduction of protein binding rate. However, the differences in degree of warfarin anticoagulation ability among the potential mechanisms remain to be clarified in clinical settings. The aim of the present study was to evaluate the changes in anticoagulation ability under the warfarin therapy before and after co-administration of antibiotics based on potential interaction mechanisms.

Methods: This single institution and retrospective study included the patients co-treated with warfarin and antibiotics at Hamamatsu University Hospital between April 2011 and March 2013. The Hamamatsu University Hospital database (analytical clinical information system entitled D*D) was examined to determine the influence of antibiotics on anticoagulation ability of warfarin. Four patient populations, vitamin K synthesis disrupted antibiotics patients (oral, VKPO group and intravenous, VKIV group) and cytochrome P450 metabolism inhibited or protein binding rate reduced antibiotics patients (oral, non-VKPO group and intravenous, non-VKIV group) were grouped from the database. The changes in prothrombin time-international normalized ratio (PT-INR) have been observed before and after co-administration of antibiotics during 4 weeks in each group.

Results: Totals of 147, 211, 131, and 13 patients were included in VKPO group, VKIV group, non-VKPO group, and non-VKIV group, respectively. The mean differences of PT-INR between before and after co-administration of antibiotics (mean value of before, after co-administration) in VKPO group, VKIV group, non-VKPO group, and non-VKIV group were 0.28 (1.85, 2.13), 0.60 (1.78, 2.38), 0.34 (1.76, 2.10), and 1.23 (1.76, 2.99), respectively. The PT-INRs significantly extended under the co-administration of antibiotics in each group. In each administration route, the PT-INR changes in non-VK group were significantly higher than that in VK group. The patients who had more than 1.5 times prolongation of PT-INR under the co-administration of antibiotics in VKPO group, VKIV group, non-VKPO group, and non-VKIV group were 8%, 15%, 21%, and 45%, respectively.

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Conclusion: This study revealed that several concomitant antibiotics increased the excessive anticoagulation ability in patients receiving warfarin. Patients co-treated with antibiotics possessing the other mechanisms with disrupting vitamin K synthesis had higher risk of excessive anticoagulation ability under the warfarin therapy. These findings suggested that frequent PT-INR testing in patients receiving warfarin is necessary during the co-administration with antibiotics possessing the other mechanisms with disrupting vitamin K synthesis.

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6-069

Category: Drug-Use Evaluation

Title: Community-based fluoroquinolones intake in Lebanon: appropriate use, misuse or abuse?

Primary Author: Rony Zeenny; Email: rony.zeenny@lau.edu.lb

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Purpose: The objective of the study was to assess prospectively the use of fluoroquinolones in a sample of community based patients.

Methods: A 12-week, observational study in several community pharmacies across Lebanon was conducted to assess Fluoroquinolone use in the community. A 16-item questionnaire was designed to collect information related to: a) Appropriateness of fluoroquinolones regimen, duration of therapy, monitoring tests, b) Frequency of side effects experienced, c) Validity and completeness of counseling information provided, in addition to d) Prescribing habits in the community. Inclusion criteria were outpatients who are currently receiving oral fluoroquinolone therapy for any indication. The subjects participation in the survey was on voluntary basis. The study was approved by the institutional review board.

Results: A total of 141 patients met the inclusion criteria. The mean age was 39 years with 57% of females. Ciprofloxacin (43%), Levofloxacin (26%), and ofloxacin (21%) were the most prescribed agents. Fluoroquinolones were mostly prescribed for skin and soft tissue infections (25%), followed by community acquired pneumonia (16%). Main side effects experienced were gastro-intestinal (13%), and central nervous system related (8%). Cultures were done to 19% of subjects. Very few received some type of laboratory tests monitoring. Around 17% of subjects were identified to have a drug-drug interaction secondary to their fluoroquinolones intake. The analysis of the regimens, and indications showed that 72% were correctly treated, while 28% were considered inappropriately treated. Interestingly, most of the patients were not appropriately counseled by their prescribing physicians.

Conclusion: Fluoroquinolones were inappropriately prescribed in 28% of the cases, and patients were not adequately informed about their use. Therefore, pharmacists should fill in the gap of patient education, and put more emphasis on counseling patients on the proper use of fluoroquinolones to optimize their use.

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6-070

Category: Emergency Medicine / Emergency Room

Title: Impact of a pharmacist on medication reconciliation in a community hospital emergency department

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Purpose: Emergency pharmacy services are a growing trend in pharmacy practice. It has been demonstrated in the literature that a pharmacist can improve the accuracy and completeness of patients medication histories. This analysis was conducted to determine the impact of a pharmacist on medication reconciliation in a community hospital emergency department (ED) and the perceptions of the ED staff regarding the addition of a pharmacist to the ED.

Methods: Medication histories were acquired by a pharmacist from patients who were admitted to the hospital through the emergency department over a 100 day period between the months of February 2014 and May 2014. Data from medication reconciliations were retrospectively counted. The medication reconciliation clarifications (consisting of the addition of a medication to the patients home medication list, deletion of a medication from the patients home medication list, incorrect doses, incorrect frequencies, incomplete orders, or missing routes of administration) were documented. The medication reconciliation clarifications were compared to two previous analyses at our hospital (from a pharmacist-guided ED pharmacy student program and prior to pharmacy presence in the ED). Additionally, a survey was taken by the ED staff utilizing SurveyMonkey in order to assess the perceived value of a pharmacist on medication reconciliation and ED pharmacy services in general.

Results: Throughout the 100 days a total of 4515 medication reconciliation interventions occurred. Additionally, a survey of the ED staff (including nurses, physician assistants, and physicians) demonstrated a strong satisfaction with a pharmacists involvement in medication reconciliation as well as additional ED services. The impact and number of medication reconciliation clarifications by the pharmacist was compared to two previous analyses at our hospital involving possible interventions prior to pharmacy presence in the ED and following the addition of a pharmacist-guided ED pharmacy student program, during which a total of 587 clarifications of home medication reconciliation lists were performed.

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Conclusion: The addition of a pharmacist to the ED in order to conduct medication reconciliation appears to be a valuable option to efficiently clarify patients home medication. The pharmacist is also perceived to be a valuable member of the ED team.

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6-071

Category: Emergency Medicine / Emergency Room

Title: Advanced pharmacy practice experiences for pharmacy students in emergency department settings

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Purpose: Pharmacy practice in the emergency department has grown dramatically over the past decade. It is unclear what training opportunities exist for pharmacy students in emergency department settings. The purpose of this investigation was to determine the percentage of schools or colleges of pharmacy routinely offer an advanced pharmacy practice rotation experience in the emergency department. Secondary objectives included the longevity of these offerings, how the rotation is classified, and the extent to which these rotations are offered by full-time faculty of the school or college.

Methods: The survey instrument was developed with questions that could be answered by the person in charge of experiential education (or designee) at each school or college. The survey was built using a commercially available internet-based tool. To be included, each college or school of pharmacy must be in the United States or Puerto Rico and be fully accredited, have candidate status, or have precandidate status as assessed by the Accreditation Council for Pharmacy Education. Schools or colleges of pharmacy with branch campuses operating under a single accreditation were requested to submit one survey representing all campuses. An initial e-mail was sent to the person responsible for advanced pharmacy practice experiences at each school or college of pharmacy. This was commonly the Director or Dean of Experiential Education. There were follow-up e-mails generated once weekly to remind participants to complete the survey and two during the last week. If participants elected to be included in a drawing, they could win one of eight \$50 gift cards to large online retailer. The recipients for the weekly drawing randomly selected using a freely available, internet-based random sequence generator. Data were entered into an electronic spreadsheet and descriptive statistics calculated as appropriate.

Results: The survey was sent to 130 colleges or schools of pharmacy. Fifty-eight were valid making the effective response rate 44.6%. Most schools or colleges of pharmacy offered this type of rotation (86.2%). The respondents represented 6402 graduates annually offering 586 (9.2% graduates) rotations for 5.4 5.3 years (mean SD). The distribution of locations where these rotations take place is community hospitals (60.3%), academic/university (54.4%), Veterans Affairs/governmental (10.3%), pediatric (6.9%), or other (6.9%). Respondents could check more than one category so percentages sum to greater than 100%. A higher percentage classified as public offered an APPE in the ED compared with private (91.3% versus 80% respectively, $p>0.05$). Stratification by class size or year of inaugural graduation did not reveal any significant

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differences. While the majority of those offering a rotation in emergency settings did not have a faculty member dedicated to this area of practice (67%), there were 19 faculty members who were identified at 16 different schools or colleges of pharmacy. Fourteen had one faculty member, one had two, and one listed three faculty members with practicing in the emergency department. The areas of practice were community hospitals (58%), teaching/university (31.6%), or trauma (5.3%).

Conclusion: The majority of schools or colleges of pharmacy offer a rotation in the ED; however less than 10% of graduates will be exposed to this type of educational opportunity. Students are most likely to have their APPE rotation in community hospitals. Faculty members practicing in the ED were common in colleges and schools of pharmacy, but not ubiquitous with usual practices being community hospitals.

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Professional Poster Abstract

6-072

Category: Emergency Medicine / Emergency Room

Title: Development of an advanced pharmacy practice experience in emergency services

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Purpose: To design, implement, and assess an advanced pharmacy practice experience in emergency services.

Methods: This occurred at a single tertiary care hospital emergency room certified for level II trauma, stroke, and chest pain. This emergency room had 20 hours of dedicated pharmacy presence prior to implementation. Students were integrated into the emergency department of a level II trauma center providing pharmaceutical services for a 4 week advanced pharmacy practice experience (APPE). Students interviewed patients, provided discharge education, reviewed admission medication lists, and attended emergent medical situations. Three methods of assessment were used to evaluate the APPE: preceptor evaluation of the student, student evaluation of the experience, and the interventions made by the student.

Results: Student involvement and independence in the emergency department increased as the rotation progressed. Students strengthened skills and knowledge in many areas of pharmacy. Students averaged 25 interventions a month with an acceptance rate of 99.4%. Students rated most questions regarding the evaluation of the APPE at 5 out of 5 with 5 being strongly agree.

Conclusion: This emergency services rotation provided students with experiences and knowledge they would not gain in other rotations. Students felt the rotation contributed to their professional growth and provided a valuable service to the hospital.

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6-073

Category: Emergency Medicine / Emergency Room

Title: Survey of emergency medicine pharmacy education opportunities for students and residents

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Nicole Acquisto

Purpose: Pharmacy services in the emergency department (ED) have been consistently shown to improve patient outcomes and decrease avoidable medication adverse events. Demand for these services within the ED has increased. While there has been an expansion over the past decade of emergency medicine (EM)-related pharmacy training and education, the extent is currently unknown. The purpose of this prospective, national survey study is to determine the prevalence and nature of EM clinical pharmacy training available to pharmacy students and residents. This study was funded by the ASHP Foundation Pharmacy Resident Practice-Based Research Grant.

Methods: Surveys were developed utilizing Survey Monkey (Survey Monkey Inc., Portland, OR) and distributed via e-mail to Department of Pharmacy Practice Chairs and Experiential Education Directors or the equivalent at United States Colleges of Pharmacy as well as Post-Graduate Year (PGY)-1 Pharmacy Residency Directors at identified institutions. A comprehensive list of the aforementioned individuals was compiled using the American College of Pharmacy Education website and Online Residency Directory from ASHP. The College or School of Pharmacy representative was surveyed regarding education opportunities for pharmacy students. The residency directors had the option to answer questions related to resident only or resident and student education opportunities at their institution. Demographic questions as well as questions related to opportunities offered for students, IPPE and APPE rotations, PGY1 residents, and non-EM PGY2 residents were asked. Institution and College or School of Pharmacy names were collected to evaluate for duplications. Duplications were handled by deleting the response that answered less questions of the survey. The survey was voluntary, however a weekly and grand prize drawing were offered to participants to encourage response. There were also five reminder e-mails sent over the five week survey period to improve response. Data gathered is presented utilizing descriptive statistics.

Results: A total of 57/110 (52%) of Colleges or Schools of Pharmacy representatives and 286/831 (34%) of residency program directors completed the survey. The College or School of Pharmacy representative reported a full-time faculty member with an EM practice site at 11/57 (19.3%) of institutions and 7/57 (12.3%) have an EM-specific section of the therapeutics curriculum. Pharmacy students are reportedly offered EM IPPEs and APPEs at 12/57 (21.1%) and 44/57 (77.2%), respectively. Of the institutions that responded, 172/286 (60%) had dedicated

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(> 4 hours per day) EM clinical pharmacy services and 15 had PGY2 EM programs. EM-focused rotations were available for PGY1 residents at 212/286 (74.1%) of responding institutions, of which 59/212 (27.8%) required the EM rotation. A total of 157/286 (52.4%) respondents had a PGY2 residency program with 83/157 (52.8%) offering their non-EM PGY2 residents a rotation in EM. The EM rotation was required for non-EM PGY2 residents at 40/157 (25.5%) institutions. The majority (52.5%) of EM pharmacy resident rotations had been available < 5 years.

Conclusion: This survey of current EM-related pharmacy education practices is the first step to understand the prevalence and type of training opportunities. Furthermore, this study calls for the development of standardization of training opportunities for pharmacy students and residents to meet the growing need of this clinical specialty.

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Professional Poster Abstract

6-074

Category: Emergency Medicine / Emergency Room

Title: Is CURES the cure? A prospective, observational study of the impact of a priori knowledge of controlled substance history

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Purpose: Evaluate the impact of a priori knowledge of a patient's controlled-substance prescription history on incidence of 1) opioids administered in emergency department (ED) and 2) prescriptions for opioids provided at discharge in patients that met a predefined drug-seeking behavior (DSB) criterion.

Methods: Medical records and CURES (Controlled Substance Utilization Review and Evaluation System) report of patients seen in the ED in March 2013 were reviewed as control cohort. Prospective cohort was collected one year later in March, 2014. Patients medical history, controlled substance history, ED medication administration records, ED visits history, and CURES report prior to and 30 days post visit were collected. Opioid doses were standardized to oral morphine equivalents.

Results: 327 patients (165 control, 162 prospective) were enrolled. An equal proportion of patients meeting DSB criteria were seen in the control and prospective cohorts (20.9% vs. 20.4%, $p=0.913$). There was no significant difference in the proportion of patients who received an opioid in the ED (52.1% vs. 49.8%, $p=0.218$), mean oral morphine equivalents given in the ED (13.86 mg SD=4.87 mg vs. 10.19 mg SD=5.04 mg, $p=0.375$), or incidence of opioid prescriptions given upon discharge (43.6% vs. 40.7%, $p=0.654$). There was a significant increase in the incidence of opioid prescriptions written for those not meeting DSB criteria in the prospective cohort (68.1% vs. 83.3%, $p=0.048$) and a significant decrease in the incidence of opioid prescriptions written for those meeting DSB criteria in the prospective cohort (31.9% vs. 16.7%, $p=0.037$).

Conclusion: CURES report at the point of prescribing did not significantly change the incidence of opioids given in the ED. However, it did significantly decrease the incidence that patients meeting DSB criteria received an opioid at discharge, and significantly increased the incidence in those who did not meet DSB. CURES report review provides clinicians with a useful tool in assessing appropriate opioid prescribing.

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Professional Poster Abstract

6-075

Category: Emergency Medicine / Emergency Room

Title: Empiric weight-based vancomycin dosing using clinical decision support in the emergency department

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Purpose: This evaluation was conducted to assess the effectiveness of a clinical decision support (CDS) tool in guiding empiric weight-based doses of vancomycin according to our institutional guidelines for patients in the emergency department (ED). Recent publications have demonstrated suboptimal vancomycin dosing strategies in the ED. Vancomycin dosing in the ED has also been shown to influence the subsequent inpatient dose.

Methods: This study underwent institutional review board assessment and was determined to be a quality improvement initiative, and did not require further review. The study was a retrospective chart review that analyzed six months of data before and after implementation of the vancomycin CDS tool. The CDS tool was implemented for adult ED patients. The tool provided the prescriber with a list of four weight ranges (less than 50 kg, 50 to 75 kg, 75 to 90 kg, and greater than 90 kg) and recommendations for which dose should be ordered in a patient within the corresponding weight range. Vancomycin orders were included if the patient was greater than or equal to 18 years of age and in the ED at the time of order entry. Orders were excluded if they were duplicates, changed, or the patient had received a prior dose of vancomycin. The primary outcome was the rate of selected vancomycin doses that corresponded with the institutional vancomycin dosing guidelines. Secondary outcomes included the difference, pre- and post CDS tool, in median time to administration and orders that required intervention by a pharmacist.

Results: In the pre- and post-implementation groups, 693 and 755 ED vancomycin orders were included, respectively. The rate of selecting recommended weight-based doses was 58.0 percent in the pre-implementation group and 67.3 percent in the post-implementation group (p less than 0.001). When stratified by the four weight groups, all groups experienced a significant increase in recommended dose selection. Overall, orders requiring a pharmacist intervention did not differ between the groups. (33.0 percent vs. 29.1 percent, p equals 0.11). Orders requiring a drug therapy recommendation from a pharmacist decreased (22.6 percent vs. 15.1 percent, p less than 0.001). Median time to administration increased between the two groups (61.5 minutes vs. 66 minutes, p equals 0.04). The increase in administration time after implementation of the CDS tool may have been confounded by a few variables. Our ED does not have 24-hour ED pharmacist coverage, therefore, some doses may have been ordered during overnight hours in

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which an ED pharmacist was unavailable. Another confounding element to these results is the workflow of medication acquisition, where doses requiring admixture (1.25 gram and 1.5 gram) are dispensed from the central inpatient pharmacy, whereas 1 gram premix doses are dispensed from automated dispensing cabinets within the ED.

Conclusion: The implementation of a CDS tool for selection of weight-based vancomycin doses in the ED demonstrated a positive impact in guiding prescribers. After implementation of the CDS tool, pharmacists did not need to intervene on as many orders as previously. Implementation of the CDS tool may have led to an increase in median time to administration, however, a four-minute difference in time to administration may be clinically negligible. This intervention in the electronic health record demonstrated that decision support implementations can demonstrate positive outcomes.

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6-076

Category: Emergency Preparedness

Title: Survey of disaster preparedness curricula in pharmacy education

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Purpose: Current literature describes the role of a pharmacist involvement on a local, regional, and national level in different disaster settings; however, details for education to student-pharmacists are limited. The purpose of this survey is to determine the inclusion of disaster preparedness in the required course work of pharmacy students and to identify the content areas addressed. In addition, it is to assess if there is student awareness of opportunities to get involved as a future pharmacist.

Methods: An electronic survey was sent to Deans of all accredited schools and colleges of pharmacy throughout the United States. The survey included questions regarding the inclusion of disaster medicine/preparedness in the required school curricula and the content of instruction given by the last year of didactic lectures. In addition, the survey also assessed the inclusion of disaster preparedness opportunities in any elective courses offered. The survey data was collected then entered into a database for analysis using descriptive statistics. This study was approved by the Institutional Review Board prior to data collection.

Results: Of the 112 schools, 52 responded to the survey (~50 % response rate). Eighty percent stated they include disaster preparedness education in their curricula, with 13% having a full course, 84% include it as part of a course, and 6% had an elective dedicated. Of the 20 percent that did not include it in their curriculum, 30 percent stated they were in the process of adding lectures or revising their entire curriculum to include disaster preparedness education. Terrorism-related education was divided into chemical, biological, radiological, and explosive with inclusion in the curricula reported as 84%, 100%, 47%, and 41%, respectively. There was 82% that also include natural disaster-related education in the curricula. In addition, 76% reported the schools affiliations have disaster preparedness protocols and conduct training.

Conclusion: This survey shows that disaster preparedness education is present in many curricula across the schools; however, it is not standardized. This raises awareness of the need for further emphasis and implementation of appropriate courses and training of future pharmacists. Advocating standardization of disaster preparedness as part of pharmacy education is needed. As disaster preparedness is by nature inter-professional, the development of inter-professional education for it is essential.

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6-077

Category: General Clinical Practice

Title: Impact of pharmacist intervention in discharge medication reconciliation process on medication errors and core measure failures

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Purpose: Medication discrepancies are a common problem in inpatient hospital settings affecting patients in their transitions of care. Discharge medication reconciliation allows the clinician to review home medications and active inpatient orders to create an accurate discharge medication list for the patient. This medication review is vital to decreasing medication errors, readmissions, and adverse drug events post discharge. The purpose of this study was to establish a consistent workflow for the discharge process, to decrease medication errors and core measure failures associated with incomplete and inaccurate discharge medication reconciliation and to increase the number of patients counseled by a pharmacist at discharge.

Methods: With assistance of nursing staff a discharge process map was developed. The pharmacist used this standardized process to review discharge medication reconciliation of 1,769 patients from Jan. 21, 2013 through Jan. 21, 2014. All interventions made to correct the identified errors in the reconciliation were documented by number and type of patients, types of interventions and patients counseled.

Results: The pharmacist reviewed a total of 1,769 patients of which 63% had at least one error on medication reconciliation. A total of 2,880 errors were identified and corrected. Of the 1,769 patients, 799 (45%) were core measure patients. Pharmacist intervention prevented an average of 43% core measure failure in core measure patients. Discharge counseling was performed on 1,108 (63%) of the 1,769 patients reviewed.

Conclusion: Pharmacist involvement in discharge medication reconciliation ensures accuracy of the discharge medication list and discharge patient counseling affords the opportunity to emphasize therapy compliance to the patient.

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6-078

Category: General Clinical Practice

Title: Medication safety improvement process: implementation of process to reduce readmission rates and improve patient safety

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Purpose: Development and implementation of a program to improve patient safety, reduce medication errors, improve HCAHPS scores, reduce patient 30 day readmission rates, and to improve patient compliance and understanding of medications at discharge.

Methods: Emphasis placed on medication reconciliation and discharge counseling by utilizing pharmacists and medication history technicians to provide safe medication management for our patients and prevent readmissions. Increase in pharmacists on nursing units ratio 1 pharmacist to 20 patients. Increased and consistent pharmacist coverage on assigned nursing units. Enhanced focused patient care. Pharmacy techs in the ED for medication reconciliation. Improve patient education and compliance with medications. Medicines in Hand program for heart failure, acute myocardial infarct and pneumonia patients. Success Through Failure classes to prevent 30 day readmission rates. Specialized focus on HF, AMI, Pneumonia and SCIP.

Results: Reduced 30-day readmission rates for patients discharged and counseled on medications: CHF 30 day readmit rate was 12.1% (Facility overall rate 23.2%), AMI 30 day readmit rate was 5.1% (facility overall rate 19.1%), pneumonia 30 day readmit rate was 5.2% (Facility overall rate 10.4%). These are below the facility 30 day readmit rates. Success Through Failure multidisciplinary classes implemented 3 days a week. All heart failure patients are offered the class. One on one classes offered to patients if cannot leave room. ED techs started 11/4/13. Improved medication reconciliation process and reduced errors and missing information during physician medication reconciliation process. Unit based pharmacists deployed to all nursing units. Ratio 1 pharmacist to 20 to 25 patients. Activities include completion of medication histories, patient rounding, and patient discharge counseling for all patients being discharged home. Facility HCAHPS scores on overall rate and communication regarding Medications increased since implementation of processes.

Conclusion: Implementation of multidisciplinary program resulted in reduced 30 day readmission rates compared to overall facility readmission rates, reduction in medications errors

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and pharmacist time due to lack of correct medication histories upon admission, and improved HCAPS scores associated with medication communication.

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6-079

Category: General Clinical Practice

Title: Probable gabapentin-induced syndrome of inappropriate antidiuretic hormone secretion: case report and review of the literature

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Case Report

Purpose: Gabapentin and pregabalin are gamma-amino butyric acid (GABA) derivatives each associated with hyponatremia, but conclusive reports of drug-induced syndrome of inappropriate antidiuretic hormone secretion (SIADH) are lacking at this time. The purpose of this communication is to convey a case of SIADH development after initiation of gabapentin during hospitalization with critique of this case and past reports using the Naranjo algorithm. The patient, a 54 year old female, presented as a level II trauma after a high speed motor vehicle crash. A formal trauma workup found the following: right 5th-7th rib fracture, left acetabulum fracture and dislocation, left ankle dislocation, and open right ankle fracture. She had a past medical history consisting of fibromyalgia for which she was taking methocarbamol 1,000 mg twice daily. She reported also taking 1,000 mg of acetaminophen twice daily, cholecalciferol 1,000 units daily, elemental magnesium 250 mg daily, omeprazole 20 mg daily, calcium carbonate as needed, and a multivitamin daily. Her hospital course involved right open subtalar reduction, left talonavicular reduction and left hip reduction and traction pin placement on day 1 followed by re-pinning of left hip, ORIF of left acetabulum and re-splinting of bilateral calcaneal fractures on days 2-4. On day 5, she was noted to have good pain control, but was experiencing paresthesias of her feet. For this reason, gabapentin therapy was started as 300 mg three times daily. On day 9, the patient developed fatigue and irritability, and was found to have serum sodium of 119 mmol/L in the setting of increased urine output and bowel movements. On physical examination the patient was A&Ox3, clinically euvolemic with extremities warm and well-perfused. Markers pertinent to the diagnosis of SIADH included: serum osmolality 243 mOsm/kg, urine osmolality 483 mOsm/kg, urine sodium 145 mmol/L, and uric acid 1.0 mg/dL with normal morning cortisol and thyroid panel. Gabapentin was discontinued that morning due to a possible association with SIADH identified in previous case reports. Following a trial of 0.9% sodium chloride infusion at 100 mL/hr for ten hours, serum sodium trended down to 116 mmol/L. The patient was subsequently placed on fluid restriction, started on sodium chloride tablets scheduled as 3 grams orally three times daily, and serum sodium trended up to 128 mmol/L by hospital day 11 when she was discharged to an acute rehabilitation facility. Medications upon discharge consisted of continuation of all prior to admission medications and opioid analgesia therapy. After discharge, serum sodium levels continued to correct; however, remained below the normal laboratory range for another week. We present a 54 year old female patient with multiple fractures in the setting of trauma who developed SIADH shortly after being

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started on gabapentin. Evidence to support diagnosis included clinical evidence of euvolemia, decreased serum osmolality, elevated urine osmolality, and elevated urine sodium. Hyponatremia improved following cessation of gabapentin in addition to fluid restriction and administration of sodium chloride tablets on hospital days 10 and 11. Three past cases of either gabapentin- or pregabalin-induced SIADH as well as hyponatremia where SIADH could not be excluded were identified in the literature and assessed using the Naranjo algorithm. Using the Naranjo algorithm we assigned a score of 6 to our case, which suggests a probable association. The other case reports were assigned scores ranging from 1 to 6. The major limitation to the other case reports as well as our own was the inability to establish clear causality due to starting fluid restriction at the same time gabapentin or pregabalin were discontinued.

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6-080

Category: General Clinical Practice

Title: Implementation of a pharmacy discharge medication education program

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Purpose: At our teaching hospital, it was noted that the overall HCHAPS scores for Communications about Medicines from patients discharged July 2011 through July 2013 were falling in the range below the 50th percentile of the CMS national average score. To address this issue, a Patient- and Family-Centered Care (PFCC) workgroup was established and charged with improving patient education regarding medications through counseling at discharge. This group included representatives from Pharmacy, Nursing, Internal Medicine physicians, CRNPs, administration, and Information Technology. It was determined that a Pharmacy-driven program of patient discharge medication education would be the ideal patient experience.

Methods: A process was established whereby pharmacists and pharmacy interns conducted educational sessions with a majority of patients admitted to the selected nursing unit. One decentralized pharmacist served as the project leader, directing the interns and serving as a liaison between patients, nurses, and CRNPs/medical staff. The project was limited to weekdays, when staff was available. Four pharmacy interns worked closely with the pharmacists to: visit every patient within 24 hours of admission; review patients medication profiles; prepare educational materials; and assist the pharmacist during patient counseling. A simple medication teaching card was developed to give to patients for each new medication prescribed. The interns also developed a small wallet card for the patients to list their medications, instructions, and physician contact information. To prioritize daily workflow, the decentralized pharmacist contacted the charge nurse to determine which patients were likely to be discharged that day. However, it was felt that an automated method of consulting the pharmacists would expedite the process. An Informatics System analyst was consulted, who established a Pharmacy Consult order through the hospital eRecord system. This allowed the nurse or discharging CRNP to electronically consult the pharmacist. This resulted in quick identification of patients being prepared for discharge.

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Results: To measure improvement in patient satisfaction and medication education, HCAHPS scores were monitored. Specifically, two HCAHPS questions were targeted: Question 16: Before giving you any new medicine, how often did hospital staff tell you what the medicine was for? Question 17: Before giving you any new medicine, how often did hospital staff describe side effects in a way you could understand Six months after initiation of the Pharmacy Discharge Medication program, HCAHPS scores were examined. The overall score for Medication Communication increased from 53% prior to the program to 65% after the program was implemented. The project goals were successfully met as evidenced by Implementation of a Pharmacy program providing discharge medication education Increased patient understanding of medication regimens based on improvement in HCAHPS scores from previous year: 23% increase for overall medication communication 20% increase for medication indication 34% increase for medication side effects Improved patient experience by providing educational materials and the opportunity to ask the pharmacist medication questions The overall score for Medication Communication for this nursing unit for surveys received in March and April of 2014 was sustained at 65%. This data reflects the experience of patients discharged from February through April 2014.

Conclusion: This project demonstrated that implementation of a pharmacy-driven patient discharge medication education program has a significant impact on patient understanding of medications, as evidenced by increased HCAHPS scores. This project was undertaken without additional staff from the Pharmacy department. Department workflow was carefully analyzed and restructured to accommodate the project and provide time for pharmacists to conduct the patient education sessions. Student interns greatly contributed to the success of this program. They reviewed medication profiles of patients approaching discharge, preparing medication teaching cards and noting anything requiring the pharmacists attention. This preparatory work greatly increased the efficiency of the pharmacists.

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6-081

Category: General Clinical Practice

Title: Drug-related suicides: findings from post-mortem toxicology screens

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Purpose: Prescription drug abuse has become increasingly prevalent. The increased misuse of prescription medications has led to increased mortality. Emergency rooms have reported increasing medication related suicide attempts. Prescription medications and alcohol overdose are responsible for a significant number of suicides. The purpose of this study was to identify the cause of death in suicides recorded by the Ada County Coroners Office during 2011 and 2012.

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. Specifically, autopsies with a manner of death of suicide were examined. Data collected included each subjects age, gender, post-mortem blood concentrations of over 50 drugs both legal and illicit (toxicology screens), as well as the coroners manner and cause of death.

Results: Thirty two subjects (20 female and 12 male) were identified as suicides. The average age of all subjects was 46 years; females average age 46 (19-68 years) and males 49 (25-82 years). The average number of drugs identified per subject was 3.9 (range 1-11); females 4.4 (range 1-11) and males 3.08 (range 1-6). Alcohol was involved in 35% of female suicides as compared to 58% of male suicides. Illicit drugs were found in 10% and 15% of females and males, respectively. Eighty eight percent of females had prescription drugs found on toxicology screen compared to 75% of males. Benzodiazepines (BZDs), opioids, selective serotonin reuptake inhibitors (SSRIs), other antidepressants (serotonin/norepinephrine reuptake inhibitors SNRI, tricyclics TCA), and other CNS acting drugs were evaluated. BZDs were found in 55% females and 42% of males toxicology screens. Opioids were identified in 30% females and 17% males, SSRIs 65% females and 50% males, other antidepressants in 55% females and 17% males, and other CNS acting drugs were identified in 80% of females and 67% of males toxicology screens. Three females (no males) had both BZDs and opioids identified on toxicology screen. Ten females (50%) had multiple antidepressants identified on toxicology screen as compared to one male.

Conclusion: Prescription drugs were identified on 88% of toxicology screens for these drug-related suicide deaths. Females were more likely to have a greater number of prescription medication involved on toxicology screens than males. Alcohol was more likely to be involved in male suicides. Of prescription medications, SSRIs, BZDs, other antidepressants, opioids, and other CNS acting drugs were commonly involved in the suicides. Females were more likely to

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have any of the previously mentioned medications on toxicology screen than males. Surprisingly, illicit drugs only accounted for 5/32 (15%) deaths. Healthcare providers need to be aware of the increasing use of prescription medications as a method of suicide. Limiting prescribing, educating patients and reducing access to these substances may reduce the number of drug-related suicides.

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6-082

Category: General Clinical Practice

Title: Pharmacy-managed asthma and chronic obstructive pulmonary disease (COPD) inhaled medication device training for nursing staff at a publicly-funded psychiatric hospital in Montana

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Purpose: Proper use of inhaled medication devices is critical in the treatment of asthma and chronic obstructive pulmonary disease (COPD). Nursing staff knowledge of and ability to assist patients in the use of inhaled medication devices was identified as an intervention to improve inhaled medication delivery. This project was designed to identify gaps in nursing staff knowledge to aid patients in effective use of inhaled medication devices.

Methods: Specialized training materials were developed by clinical pharmacists. Training materials incorporated a self-guided reading assignment, hands-on training with inhaled medication devices, and an activities checklist to be completed by each nursing staff member during training. Self-guided training materials included a section on asthma and COPD epidemiology, clinical features of asthma and COPD, guidance on assessment of respiratory symptoms, information on the inhaled medication devices used in the facility, and a list of frequently asked questions. Following the self-guided reading assignment, nurses worked with a trainer to practice appropriate priming and use of all inhaled medication devices used within the facility. Information and skills taught were evaluated using a 19-question written exam which the trainees completed independently (comprised of multiple choice, true/false, and fill-in-the-blank questions), and a skills assessment was conducted by their trainer. Incorrect questions on the written exam or skills performed incorrectly during the skills assessment were reviewed with trainees to ensure the trainee was aware of areas of weakness. Reviewing the written exam and skills assessment with the trainee also provided as opportunity to reteach the correct information or technique.

Results: Sixty-eight members of the facility nursing staff (92% of total nursing staff) completed the asthma and COPD training developed by clinical pharmacists. Several areas of weakness were determined based on the results of the written exam and the hands-on skills assessment. Main areas of weakness included proper technique in using a HandiHaler device, priming not needed for Diskus device, metered dose inhaler (MDI) device should be placed into the mouth with lips sealed around the mouthpiece when used (instead of two finger widths away from the mouth), and identifying inhalers that contain steroids and require patient mouth rinsing after each use. Weaknesses identified in the use of HandiHaler and Diskus devices were anticipated due to less frequent use of these devices compared to metered dose inhalers, and additional training was provided to those unfamiliar with appropriate use of these devices. Nurses scored very well on questions related to proper cleaning and storage of inhaled medication devices, identifying symptoms of asthma and COPD, and the rationale behind mouth-rinsing after using devices containing an inhaled corticosteroid.

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Conclusion: The educational module prepared by pharmacy staff identified areas of strength and weakness in the nursing staffs knowledge of asthma and COPD inhaled medication device use. Additional training is planned for nurses who score poorly on the exam to better meet their needs before assisting patients in the use of inhaled medications.

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6-083

Category: General Clinical Practice

Title: Pharmacy consults on adult hospitalized patients with delirium

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Purpose: To describe a unique pharmacy consult service and report on the findings and provider acceptance resulting from pharmacy consults on adult hospitalized patients having a positive assessment for delirium.

Methods: All adult patients over the age of 65 or exhibiting signs of altered mental status, admitted to a 616 bed, Level I trauma center, were assessed by nursing for altered mental status using a validated confusion assessment method (CAM) upon admission and at the change of shift. All positive CAM scores resulted in a consult to pharmacy to assess for possible drug causes. This report includes a retrospective chart review of these pharmacy consults from the beginning of the program in December 2012 to May 2014 (16 months). Data analyzed includes number of pharmacy consults, medications identified as unlikely, possible or definite causes of the positive CAM score, the medical unit at the time of the consult, and estimated frequency of medication alterations resulting from the pharmacy consults.

Results: There were a total of 1201 pharmacy consults over the 18 month period, with a monthly average of between 0.9 to 3.59 consults per day. The probability of drugs being the cause for the patients confusion was judged by pharmacists as unlikely, possible and definite in 35.2%, 44.5% and 20.2% of patients, respectively. Positive CAM scores were attributed to opioids in 36.7% of consults and benzodiazepines were identified in 21.3%. Although the combination of medical, surgical and cardiac critical and intermediate care units comprised over 33.1% of the consults, neurology critical and intermediate care units had 12.9%. The remaining 54% of consults were from general care units. The level of acceptance was determined from a sample of 36 out of 224 consults randomly selected from the last 6 months of the study period in which the pharmacists identified drug causes for the positive CAM scores. Pharmacists recommendations were accepted in 54.5% and 92.8% in which drugs were possibly or definitely associated with the patients confusion, respectively

Conclusion: A process of requesting a pharmacist consult in hospitalized patients assessed to have delirium resulted in a significant number of cases with drugs identified as possible or definite causes and the majority of resulting pharmacists recommendations being accepted.

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6-084

Category: General Clinical Practice

Title: Designing an effective pharmacist led discharge counseling program for congestive heart failure and acute myocardial infarction patients

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Purpose: Studies have shown that among Medicare patients discharged from a hospital, eighteen percent of patients have a readmission within thirty days post discharge. Medicare will no longer reimburse the hospital for patients readmitted with a diagnosis of congestive heart failure (CHF) and/or acute myocardial infarction (AMI) within that 30 day time period. Thus, at the request of our hospitals cardiologists, a pilot program was implemented to involve the pharmacist in discharge medication reconciliation and discharge medication counseling prior to hospital departure. The impact on readmission rates would be analyzed for this patient population.

Methods: A pharmacy team was put together which included pharmacy management, the clinical pharmacist, the ICU pharmacist, the neurology pharmacist, and the IT pharmacist. A checklist was developed to be followed when preparing for and conducting the discharge medication reconciliation and patient counseling. This included reviewing discharge medications and ensuring that all AMI and/or CHF core measures were being met. A tracking tool was used to document the number and type of interventions; the time spent on preparation and counseling activities, and if all CHF and /or AMI core measures was met. Finally, nursing was consulted to help set up a method to identify the patients that needed a pharmacist intervention.

Results: One hundred thirty-five patients (27% of total number of CHF/AMI patients discharged from our hospital) were counseled during the nine month trial period. The average time spent in preparation, medication reconciliation and counseling per patient was twenty minutes. The pharmacist performed 200 interventions on these patients and found that the CHF and/or AMI core measures were not met in thirteen of these patients. For our hospital there was a total readmission rate of ten percent during this time period, but only six patients that were counseled by pharmacy were readmitted. This resulted in a five percent readmission rate among the patients that were counseled by pharmacy.

Conclusion: Utilizing pharmacists for discharge medication reconciliation and counseling prior to discharge does contribute to a reduction in readmissions of CHF and AMI patients.

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6-085

Category: General Clinical Practice

Title: Evaluation of anemia management in hemodialysis patients in Lebanese centers

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Purpose: Anemia is a major complication in chronic kidney disease patients. The severity of anemia is directly associated with the stage of renal dysfunction. Optimal treatment of anemia requires adequate erythropoiesis-stimulating agents (ESA) administration, iron therapy and monitoring of the response. The aim of this study was to evaluate the adherence to Kidney Disease Outcomes Quality Initiative (KDOQI) recommendations for anemia management in end stage renal disease (ESRD). This study further assessed the impact of iron status on hemoglobin level, and the association between hemoglobin levels and morbidity.

Methods: This was a prospective, multicenter, observational study conducted at two hemodialysis centers in Beirut-Lebanon from October 2013 till April 2014. A data collection sheet was developed including demographic information about the patients and co morbidities, dialysis history, anemia parameters, pharmacologic management, and hospitalization rates during the study duration. Data collection was done on monthly basis. All hemodialysis patients were screened and only patients aged more than 18 years without history of or active cancer were enrolled. The statistical tests used were the paired sample T-test, independent sample T- test and data was analyzed using SPSS-20.0 version. P value 0.05 was defined as statistically significant. The study was approved by the Institutional Review Boards of the university and the centers.

Results: 189 hemodialysis patients were screened and 182 patients met the inclusion criteria (54.9 % males, 45.1 % females). The mean age was 57.28 years and the mean hemoglobin level for those patients was 10.29 ± 1.44 g/dL. 47 patients (26.0 %) had hemoglobin level within the target range recommended by KDOQI guideline. The difference between the prescribed and recommended doses of erythropoietin (EPO) in all 6 months was significant (p-value<0.05). The same applies to the difference between prescribed and taken doses of EPO. Mean EPO dose/week was 7585.83296 IU. The Pearson chi-square test showed that as hemoglobin level increased the mean EPO dose/week prescribed significantly decreased (p-value=0.001). Concerning the prescribed and taken iron doses, a significant difference was noted in all months (p-value <0.05) except December and April where the improvement in hemoglobin levels were the highest among all patients showing the correlation between hemoglobin improvement and adequate iron levels. Hospitalization data was available for 78 patients out of the 182. Results had shown that the mean hemoglobin level in hospitalized patients was significantly lower than the levels for non-hospitalized patients (9.92 versus 10.74 g/dL, p-value=0.046). Myocardial

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infarctions (56.9 percent) and diabetes mellitus complications (18.2 percent) were the major reasons for hospital admissions.

Conclusion: This study demonstrates that, adhering to the KDOQI recommendations for EPO dosing and managing iron status improve anemia management in hemodialysis patients. Inadequate treatment of anemia increases morbidity. This highlights the need for strict implementation of guidelines and the involvement of a clinical pharmacist in hemodialysis units for best patient outcomes.

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6-086

Category: General Clinical Practice

Title: Intravenous tranexamic acid in reducing perioperative blood loss and the need for blood transfusions in patients undergoing elective total knee and total hip arthroplasty

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Purpose: Major orthopedic surgeries, such as TKA and THA, are often associated with significant blood loss, and therefore present a constant challenge for surgeons. Tranexamic acid (TXA), an anti-fibrinolytic agent, works by inhibiting the activation of plasminogen to plasmin and by inhibiting plasmin activity directly; hence, it reduces the ability of plasmin to lyse fibrin clots. Recently, there has been a growing interest in the use of intravenous TXA to reduce blood loss and the need for blood transfusions in patients undergoing elective TKA and THA. The objective of our study is to evaluate these benefits at our facility.

Methods: Baseline data was collected retrospectively for the year 2013, from patients who underwent elective TKA and THA. The perioperative blood transfusion rate and the number of PRBCs (packed red blood cells) units used were counted. A two dose intravenous TXA regimen preoperatively and three to six hours postoperatively were given to those who met the inclusion criteria, after implementation of the new TXA protocol. Analysis of the post-op blood transfusion rate and the number of PRBCs units used from March through May, 2014, were compared with baseline.

Results: Twenty-five of the 110 TKA patients and 13 of the 44 THA patients received PRBCs post-op in 2013, accounting for 22.7 percent and 29.5 percent of each patient group, respectively. Three months data collected after implementation of the TXA protocol showed that three of the 36 TKA patients and five of the 21 THA patients received PRBCs perioperatively, representing 8.3 percent and 23.8 percent of each patient group. The TKA group showed a significant transfusion reduction of 14.7 percent, although the transfusion reduction of 5.7 percent in the THA group was not as compelling. Only the TKA group showed a significant reduction in total units of blood transfused, from 11 units to four units for the same three month period last year. There were no significant adverse events reported in the three month period, and no increased risk of thromboembolic events observed in these patients.

Conclusion: TXA has been of benefit in reducing the rate of blood transfusions required in TKA and THA surgeries, based on our observations. The reduction in the number of PRBCs units infused was observed only in the TKA group, possibly due to the short duration of our study.

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There have been no adverse events associated with the use of TXA reported since the implementation of the protocol.

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6-087

Category: General Clinical Practice

Title: Assessment of a basal-bolus insulin protocol in a community hospital.

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Purpose: Hyperglycemia is common in the inpatient setting in both diabetic and nondiabetic patients. The avoidance of high glucose levels is associated with improved patient outcomes. To better achieve glycemic control, Wood County Hospital (WCH), a 196-bed acute care hospital in Bowling Green, OH initiated a basal-bolus (BB) insulin protocol to replace an existing "sliding-scale" protocol. The purpose of this retrospective study was to evaluate how consistently the new protocol is prescribed and its effectiveness in maintaining target glucose concentrations (70-150 mg/dL) within the inpatient population.

Methods: This retrospective, chart-review analysis was approved by The University of Findlay (UF) institutional review board. Informed consent was not required for this study. A total of 79 patients who had been initiated on the BB protocol within the previous year were randomly selected for study inclusion. Each patient's electronic record was systematically reviewed for demographic data, previous history of diabetes, previous diabetic medications, all point-of-care (POC) and blood glucose determinations, and all insulin doses administered during the hospital stay. Data were analyzed to determine the proportion of patients who were prescribed the complete protocol, the mean daily glucose (MDG) concentration for each patient, and the number of patients who experienced hypoglycemia (BG < 70 mg/dL), target glycemia (70-150 mg/dL), hyperglycemia (151-240 mg/dL), and severe hyperglycemia (> 240 mg/dL). These data will be presented to the hospital's P&T Committee for protocol assessment and refinement and provide baseline data to which future protocol assessments may be compared.

Results: Records were reviewed for 79 patients who were initiated on WCH's BB insulin protocol in 2013. The mean patient age was 64.9 years and most patients were overweight (mean BMI = 33.0). In analyzing the 41 patients with a BMI above 30.0, 40 of these patients were prescribed a correction insulin dose below that recommended by the protocol. A total of 441 therapy days (5.58 per patient) and 1690 POC determinations (21.4 per patient; 3.83 per patient-day) were analyzed. The overall mean daily glucose value was 177.0 mg/dL. Only 46 (2.7%) of the POC determinations were below 70 mg/dL; but, 15.5% of the POC readings demonstrated severe hyperglycemia (> 240 mg/dL). The largest majority of patients (54.4%) were prescribed basal + correction insulin only. Patients initiated on the full protocol had improved glucose control compared to patients who did not receive prandial insulin (175.9 vs. 183.9 mg/dL).

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Conclusion: Only a minority of patients (11.4%) were initiated on the full BB protocol (basal + prandial + correction) with prescribers most commonly omitting the prandial dose. Less than 50% of the POC determinations were within the targeted range and almost 6 times more patients experienced severe hyperglycemia vs. hypoglycemia. These results were presented at a hospital P&T Committee meeting and will be further utilized as part of a broader prescriber education initiative to improve compliance with the full BB protocol. These baseline data will then be used to assess protocol performance following targeted prescriber education efforts.

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6-088

Category: General Clinical Practice

Title: Types of intravenous to oral conversions in relation to antibiotic classes in Lebanese hospitals

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Purpose: The appropriate switch from intravenous (IV) to oral (po) antibiotic therapy has positive outcomes as reduced costs, shortened length of hospital stay, and decreased complications from the route of administration. The three types of IV to po conversion include sequential, switch and step-down therapy. These types are appropriate once the patient is clinically stable, and administered to complete the remaining course of therapy. The study objective was to assess the correlation between the type of IV antimicrobial conversion and its classes.

Methods: This was a retrospective observational study conducted in three Lebanese university hospitals over a period of six months. Institutional Review Board approval was obtained from the involved centers. Patient demographics, initial diagnosis, medication history and IV antibiotics prescribed, vital signs, microbiological laboratory results and white blood cell count were obtained from the medical records. Adult inpatients on IV antibiotic for more than two days were enrolled in the study. Excluded were patients with gastrointestinal malabsorption diseases, infections that require prolonged course of IV antimicrobial therapy, or malignancies. Eligible patients were assessed for the conversion type based on the antibiotic class. IV antibiotics prescribed were divided into 6 groups: beta-lactams, macrolides, fluoroquinolones, metronidazole, aminoglycosides and glycopeptides. Chi-square or Fishers exact statistical tests were used to analyze the data. All reported p-values were two-sided with the alpha set at a significance of 0.05.

Results: A total of 452 IV antibiotic courses from the 356 included patients were assessed for the switch over from IV to po. The IV antibiotic courses were divided into 300 (66.4 percent) beta-lactams, 33 (7.3 percent) macrolides, 78 (17.3 percent) fluoroquinolones, 25 (5.5 percent) metronidazole, and 16 (3.5 percent) aminoglycosides and glycopeptides. From the patients who were converted, antibiotics were 13.7 percent of beta-lactams, 45.5 percent of macrolides, 60.3 percent of fluoroquinolones, 32 percent of metronidazole, and 5.9 percent of aminoglycosides and glycopeptides. From the IV converted antibiotics, 30.5 percent were discontinued when no definitive oral equivalent is available and 69.5 percent were converted to po therapy. Two third of the converted courses were done through sequential therapy; 100 percent for metronidazole, 89.4 percent for fluoroquinolones, and 80 percent for macrolides, with a p-value less than 0.0001. Switch and step-down therapy were minimally done in this study.

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Conclusion: The study results showed that switch over from intravenous to oral therapy was more practiced when the same antibiotic exists in both IV and oral dosage forms. The main reasons that limit the conversion from IV to po is the lack of integration and reinforcement of the guidelines in Lebanese hospitals, and the misconception that oral medications are ineffective because the bioavailability cannot be achieved to the same extent as with the intravenous medications.

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6-089

Category: General Clinical Practice

Title: Uptake of health insurance by the uninsured in response to the Patient Protection and Affordable Care Act

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Purpose: The Patient Protection and Affordable Care Act (PPACA) aims to improve access to health insurance for the over 47 million uninsured, nonelderly Americans. However, the true impact of the PPACA remains unknown and is dependent upon uptake by the uninsured population. This study was conducted to examine what factors influence uninsured patients' decisions to enroll in health insurance through the PPACA.

Methods: We designed a qualitative research study with approval from the Institutional Review Board at the University of Pittsburgh, PA. We conducted semi-structured interviews with uninsured, nonelderly adults (aged 18-64 years) at both a free clinic and a federally qualified health center in Pittsburgh. The interviews focused on patient feelings and beliefs in regards to six domains: knowledge of the PPACA, value of health insurance, motivating factors for enrolling in insurance, barriers to enrolling in insurance, assistance navigating the Marketplace, and the role of safety net sites. Transcripts were analyzed using the principles of Grounded Theory. Patients also completed a short demographic survey to evaluate eligibility for the PPACA.

Results: Thirty patients were interviewed between August 2013 and December 2013. Twenty-four patients (86%) would meet requirements for coverage through Medicaid expansion, and eleven patients (39%) were eligible for lower premiums/subsidies based on income limits. Seven themes emerged: 1) a belief that health insurance is important for health, 2) costs are the main barriers to enrollment, 3) a selective desire for insurance, 4) an unawareness of the provisions of the PPACA but a desire to understand the personal implications, 5) strong criticisms of the individual mandate and penalty provisions, 6) a high level of skepticism towards the government and insurance companies, and 7) a belief that being uninsured leads to stigmatization and decreased quality of care.

Conclusion: Providers should recognize that the majority of the uninsured desire insurance, but cost and misconceptions are significant barriers to enrollment. Expansion of Medicaid in Pennsylvania would increase access to health insurance for patients currently utilizing safety net sites.

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6-090

Category: General Clinical Practice

Title: Student perception of laptop versus tablet computer use on an internal medicine advanced pharmacy practice experience

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Purpose: With the implementation of the electronic medical records (EMRs), pharmacy students have unprecedented access to information. In the setting of patient rounding, however, information may be difficult to access on most computing devices (desktop or laptop computers). The current study aims to assess student perception of the utility of tablet devices as compared to laptops on medical rounds.

Methods: Students on an internal medicine rotation between May 1, 2011 and May 1, 2013 were randomized to use a laptop or tablet computer for 2-4 weeks then crossed-over to the alternate device for another 2-4 weeks. A voluntary, anonymous survey to collect demographic information, their perception of the devices performance in 10 categories, overall satisfaction, estimated number of technical difficulties encountered, and their preferred device was completed. Device performance was rated on a 5-point scale ranging from completely dissatisfied to completely satisfied. Comparisons of the 2 groups were performed using descriptive statistics and the paired t-test.

Results: Twenty-two surveys were completed (100% response rate). Most responders were female (63.6%), between the ages of 25 and 30 years (45.5%) and rated their computer skills as confident or better (91%). While 41% of students had used a laptop on rotations, only 9% had used a tablet device. The laptop computer scored significantly higher in the areas of EMR navigation (mean score 4.2 vs. 3.3, $p<0.01$), web browsing (4.5 vs. 3.7, $p<0.01$) and word processing (4.5 vs. 3.7, $p<0.01$). The tablet computer scored significantly higher in the areas of battery life (4.8 vs. 2.3, $p<0.0001$), portability (4.9 vs. 2.3, $p<0.0001$) and intervention documentation (4.7 vs. 2.1, $p<0.0001$). There was no significant difference in all other scores, including EMR access, EMR stability, accessing drug information sources, or accessing rotation materials (such as syllabi, rubrics, or the rotation calendar). Technical difficulties that interfered with rotation activities were rare and not different between groups (0.17). Overall satisfaction was high in each group (3.5 for laptops vs. 3.8 for tablets, $p=0.25$). If asked to choose only one device, 63.6% of respondents preferred the tablet device. Responder gender, age, previous laptop use and previous tablet use did not significantly impact the device of choice.

Conclusion: Overall, students were satisfied with both laptop and tablet devices. In order to improve access to patient data (and potentially improve the impact of student pharmacists) on

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medical rounds, tablet devices may be a suitable alternative computing device. Students feel they offer better portability, longer battery life and improve the intervention documentation process when compared to laptops.

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Category: General Clinical Practice

Title: Impact of a transitions-of-care (TOC) pharmacist on readmission rates and medication compliance in high-risk patients

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Purpose: With nearly two thirds of hospitals facing a total of \$280 million in penalties for excessive readmissions, there is increasing attention on hospitals to reduce readmission rates. The addition of a TOC pharmacist has shown to be a crucial part of safe patient discharge and may contribute to decreased readmissions.

Methods: Two TOC pharmacists with advanced training in medication therapy management (MTM) identified high-risk patients and provided the following services: assessment and removal of barriers to medication compliance; review of medication therapy for effectiveness, safety and compliance; providing patient medication education; validation of medication reconciliation list upon admission; discharge planning and follow up 30 days post discharge. High risk patients were identified by admission due to non-compliance or adverse drug event, new or unstable high risk disease states, polypharmacy, multiple medication changes to previous home medication regimen, and potential financial barriers. Readmitted patients were reviewed using root cause analysis methodology.

Results: TOC pharmacists enrolled 1328 patients from April 2013 to March 2014. Of 629 MTM encounters, there were 89 readmissions (21.4%). Of those readmissions, 3 were medication related readmissions as compared to the 20 medication related readmissions in the non-MTM group (4.9%). Medication compliance was also assessed with 90% of the patients were able to fill each of the discharged medications and 100% claimed adherence to therapy.

Conclusion: TOC pharmacists reduced readmission rates, improved ability to obtain medications and improved patient adherence to therapy.

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Category: General Clinical Practice

Title: Pharmacist participation in ketogenic diet initiation

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Purpose: The ketogenic diet is a special high-fat, low-carbohydrate diet that has been shown to help control seizures in patients with seizure activity refractory to standard pharmacotherapy. The diet eliminates desserts such as candy and cookies due to their high carbohydrate content. Unknown to most, some medications have high carbohydrate content. The medication carbohydrate goal for successful seizure control is documented to be less than 1000 milligrams of carbohydrates per day. The purpose of this project was to develop a process for pharmacists to use when evaluating carbohydrate content of medications prescribed to ensure successful initiation of a ketogenic diet.

Methods: A pharmacist with ketogenic diet experience developed a handbook and assessment that all pharmacists at the institution were required to complete. Approximately seven days prior to diet initiation, the pharmacist received orders to evaluate the patient's medication profile for carbohydrate content. Online databases related to the ketogenic diet were consulted for medication carbohydrate content. If a medication was not listed in the database, a call to the drug manufacturer was necessary. During the evaluation, the pharmacist collaborated with the physician and dietitian to decrease the carbohydrate content of the medication regimen to meet the carbohydrate goal. If indicated, the pharmacist recommended alternative medications to decrease the carbohydrate content of the medication regimen.

Results: All pharmacists completed the self-guided tutorial and assessment. The assessment ensured any pharmacist is competent to evaluate prescribed medications for a patient initiated on the ketogenic diet. A total of 10 patients have been initiated on the ketogenic diet since July 2013. A drug database has been developed documenting carbohydrate content of commonly prescribed medications. To minimize carbohydrate content, pharmacists avoided syrups, suspensions, elixirs and chewable tablets; frequently substituted capsules for tablets, enabling capsule contents to be crushed and/or sprinkled on food such as sour cream or sugar free gelatin; and maintained consistency with a specific brand or generic medication, as carbohydrate content can vary greatly between manufacturers. Additionally, medications such as valproic acid, topiramate, and zonisamide have been determined to be too high in carbohydrate content to be used during ketogenic diet initiation, thus needing to be weaned and discontinued.

Conclusion: This process has enabled pharmacists to proactively evaluate medications prescribed for ketogenic diet patients. Pharmacist participation in ketogenic diet initiation ensured the patient received a minimum amount of carbohydrates from prescribed medications.

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Pharmacists will continue to collaborate with physicians and dietitians to ensure all patients initiated on the ketogenic diet receive a minimum amount of carbohydrates from prescribed medications, facilitating better seizure control.

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6-093

Category: General Clinical Practice

Title: Budget impact analysis of combination tumor necrosis factor-alpha antagonists and methotrexate therapy in methotrexate-naive patients with newly diagnosed rheumatoid arthritis: a MassHealth perspective

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Purpose: Rheumatoid arthritis (RA) is an autoimmune disease that affects the synovial membranes of joints, causing swelling and pain. It accounts for significant disability in the US. Methotrexate and other oral disease-modifying antirheumatic drugs (DMARDs) are traditionally first-line therapy for treatment of early RA, while tumor necrosis factor (TNF) alpha antagonists are generally reserved for patients who do not respond to DMARD therapy. The purpose of this research was to evaluate the budget impact of combining methotrexate and TNF alpha antagonists in newly diagnosed patients to achieve rapid control and decrease the long-term physical and economic impacts of this disease.

Methods: Clinical and economic literature searches were conducted using Medline/EBSCOHOST, PubMed, and ScienceDirect to obtain articles that provided information on the impact of this disease and these medications. Clinical search terms included: rheumatoid arthritis, RA, tumor necrosis factor, tnf alpha, anti-tnf, methotrexate, mtx, methotrexate-naive, methotrexate vs. biologic, methotrexate vs. tumor necrosis factor antagonist, biologics, biologic agents, adalimumab, etanercept, certolizumab, infliximab, golimumab. Nine primary and six secondary clinical articles were identified. Economic search terms included: budget impact analysis, cost-effectiveness, cost utility, monotherapy, combination therapy, burden of disease, biological agents, TNF inhibitors, etanercept, adalimumab, methotrexate. Three economic articles were identified. For the structure of the budget impact analysis, certain assumptions were made based on the literature found. Using the total number of patients on MassHealth and the prevalence of RA in the US, the total target population was narrowed down to 580 patients. Rheumatologist visits for the average patient with RA occur every two months and the average dosage of methotrexate is seven and a half milligrams weekly. Approximately 27% of patients with RA are hospitalized every year due to complications, and these hospitalizations cost the health care system \$38,000 per patient per year. Adalimumab was the TNF-alpha antagonist used in all analyses.

Results: Clinical literature showed that combination therapy provided more rapid remission and decreased radiographic progression of RA without significantly increasing adverse events.

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Economic literature was inconclusive on whether or not combination therapy was cost-effective. While combination therapy would theoretically prevent negative sequelae of disease, decrease hospitalizations, and reduce costs, TNF-alpha antagonists are a significant financial burden to add to patients medication regimens. It is also important to note that many of these benefits were seen over multiple years, and our budget impact analysis focuses on the first year of therapy. When accounting for variation in assumptions in the sensitivity analysis, the difference in overall cost per year between combination therapy and methotrexate monotherapy was as much as \$33,238 per patient. This difference is so apparent because treatment for RA is largely patient-specific and many aspects of treatment could vary greatly depending on the patients response and tolerance of therapy. Patients experiencing adverse events from their medications may visit their rheumatologist more frequently than every two months, as previously assumed. These patients could also potentially require more frequent hospitalizations than the average patient. The compiled literature showed a significant clinical benefit to combination therapy, but the economic benefit was not as definite.

Conclusion: Since the budget impact analysis that we conducted was based on the first year post-diagnosis, it is difficult to justify such a significant increase in medication cost to obtain long-term benefits. It would seem that the addition of a TNF-alpha antagonist would be more justifiable when the disease is more progressed and patients could benefit more from reversing or preventing long-term complications. After a few years into treatment, combination therapy would be more cost-effective and beneficial. It would be ideal to have more long-term studies done to determine the true effects of this combination both clinically and economically

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Category: General Clinical Practice

Title: Assessment of cardiovascular surgical infection prophylaxis in a Lebanese hospital

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Purpose: The appropriate use of prophylactic antibiotics reduces the incidence of surgical site infections. Despite the advances in antiseptic measures, antibiotics, and preoperative precautions, infections are common complications from surgeries. This study was conducted to assess the appropriate prescription of antibiotics prior to cardiac surgery with respect to the choice, dose, duration, and preoperative timing among hospitalized patients in the geographic area of Lebanon.

Methods: This was a retrospective, observational, single center study conducted at a Lebanese teaching hospital from February till April 2014. Data was collected from computerized data bases for hospitalized patients who did cardiac surgeries between January 2010 till December 2013. Patients above eighteen years old undergoing Coronary Artery By-pass Graft (CABG), valve surgery, or both were eligible for study enrollment. Excluded were patients younger than eighteen years of age, prior intake of antibiotics, or had another concomitant surgery with the cardiac. Consistency with the international guidelines was evaluated for appropriate route of administration, choice, preoperative timing, duration, dosing, and redosing of antibiotics. The Institutional Review Board (IRB) approved the study design. Data was analyzed by SPSS version 20.0 and presented as frequency/percentage and mean standard deviation (SD).

Results: A total of 3000 patients were initially screened where only 245 patients met the eligibility criteria and were included in this study. Baseline age of the participants was 58.91 plus/minus 13.65 years (mean plus/minus standard deviation SD), and a body mass index of 28.19 plus/minus 5.19 Kg/m². The enrolled participants were on different intravenous antibiotic regimens, where 188 (76.7 percent) patients were on vancomycin and ceftriaxone, 15 (6.1 percent) on vancomycin and cefuroxime, 13 (5.3 percent) on ceftriaxone, 12 (4.9 percent) on vancomycin, 6 (2.4 percent) on cefuroxime, 2 (0.8 percent) on clindamycin, and the others were on combination of gentamicin and a cephalosporin. Only twelve (4.9 percent) from the enrolled patients were consistent with the treatment guidelines regarding the choice of the antibiotic. For those patients who were given the appropriate antibiotics, proper dose was found in only seven patients (58.7 percent), and out of five patients (2 percent) who required redosing only four were given the appropriate doses. As for the preoperative timing, patients regimens consistent with the guidelines were given vancomycin within 120 minutes prior to surgery and 60 minutes for the others. However, when vancomycin was combined with other antibiotics, both drugs were administered within 120 minutes of incision which was not appropriate, and took place in 202

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cases (82.4 percent). Prophylaxis was extended beyond one day in 173 patients (70.61 percent) and the average duration was 2.8531 days 2.07514.

Conclusion: This study demonstrates that in cardiac surgeries, the optimal choice of antibiotics is seldom administered, duration of prophylaxis is excessively long, and the preoperative dose timing is rarely employed. More education and communication are required to improve these practices to reduce risks of surgical site infections, prevent resistance, and limit costs potentially associated with antibiotic misuse. The role of clinical pharmacist may facilitate this process across all surgical disciplines through interventions that should be implemented to optimize the perioperative antibiotic prophylaxis in procedures.

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6-095

Category: Geriatrics

Title: Patterns of medication use in African Americans with depression: results from the beat the blues randomized clinical trial

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Purpose: Depression exerts significant morbidity in older adults, and when undetected or inadequately treated has been associated with increased risk of falls, functional decline, and increased cardiovascular mortality. Minority populations such as African Americans (AA) may be at particular risk for inadequate treatment, with prior research indicating a major gap between whites and AA antidepressant use. This analysis examines the frequency and types of antidepressant medications reported at baseline in a randomized clinical trial of the Beat the Blues non-pharmacological depression program for older AA, and compares participants reporting an antidepressant to those not reporting an antidepressant.

Methods: Participants were enrolled in the trial in 2009 and 2010 and eligible if they had depressive symptoms (Patient Health Questionnaire (PHQ-9) score 5-15, with higher scores indicating > severity of depressive symptoms), were African American, >55 years, English speaking, and cognitively intact (Mini Mental Status Exam >24). Baseline data were recorded by a trained interviewer and included demographics, co-morbidities, functionality (Activities of Daily Living, Instrumental Activities of Daily Living, and mobility), and antidepressant medication use, as well as other medication classes which may concomitantly be used in depression: anxiolytics, sleep medications, pain medications, and memory medications. Medication data were reviewed post hoc by a pharmacist to ensure accurate name and pharmacological classification. The chi-squared test and independent t-test were used to analyze all discrete and continuous variables, respectively.

Results: The analysis included 129 participants with a mean age of 68.7 years and mean PHQ-9 score of 12.6 (SD 5.1). 25 participants reported taking an antidepressant (AD group; 19.4%) compared to 104 not reporting antidepressant (NAD group; 80.6%). AD participants were statistically similar to NAD in terms of age, gender, education completed, marital status, level of financial difficulty, number of co-morbid medical conditions, and mean PHQ-9 score. 20 participants out of the 129 included in this analysis (15.5%) reported taking a selective serotonin reuptake inhibitor for depression, 5 reported taking a tricyclic antidepressant (3.9%), 2 reported taking a serotonin-norepinephrine reuptake inhibitor (1.6%), and 1 reported taking a norepinephrine and dopamine reuptake inhibitor (0.8%). When comparing frequencies of

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additional medications taken, analgesics were the most frequently reported medication class, with a mean of 1.44 analgesics/person AD vs. 1.34 analgesics/person for NAD ($p=0.806$; not statistically significant). AD participants more frequently reported an anxiolytic ($p<0.027$). No other statistically significant differences were identified between the two groups in terms of analgesic, sleep, or memory medication usage.

Conclusion: In this sample of individuals who had depressive symptoms based on a screening tool, nearly one fifth reported an antidepressant medication at baseline. Use of pharmacological therapies does not preclude non-pharmacological therapies, as those on antidepressants may benefit from additional treatment. Pharmacists can play a key role in managing the use of these drugs and should recommend non-pharmacological approaches as a suitable treatment option for this population.

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6-096

Category: Geriatrics

Title: Reconciliation and revision of medication at admission in nursing homes

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Purpose: Government Health Plan 2011-2015 in the prevention and care program to chronicity (PPAC) in Catalonia, focus on the review and reconciliation of medications. To implement it successfully in the 160 nursing homes where we provide Health Care Assistance (EAR), the pharmacy department has established to do the reconciliation and medication review simultaneously at the admission.

Methods: Prospective study, in the implementation of reconciliation and medication review plan by the Consultant Pharmacist, for two months, at the patient admission in the nursing home. The objectives of the review were: detection of medication errors, indication of drugs in the patient medication plan, appropriateness of the medication in the current clinical situation of the patient, prevention of medication related problems, maximize efficiency and encourage the standardization of the safe use of medications. Using an algorithm developed by the Pharmacy Service of our institution according to criteria of efficacy, safety, efficiency and standards in geriatrics. Data were obtained from HC3 (Electronic Shared Medical Record of Catalonia) and other information provided by the health team from the nursing home. The Consultant Pharmacists gives a report to the EAR team (physician and nurses) with suggested interventions. We conducted a follow up of the recommendations, resolution, interventions and any question from the EAR teams.

Results: Medication plans of 202 patients (mean age 85.2 years) were reviewed/conciliated, with a total of 408 interventions, being these: Prescription errors (4.7%) Inappropriate and avoidable medication in geriatric patients (17.4%) Dosage adjust (renal or hepatic impairment) (4.4%), Stop medication (lipid-lowering treatments in primary prevention in patients over 80 years old, proton pump inhibitors without indication, more than 5 years bisphosphonates) (19.4%) Duplicated medications (3.2%) Risks combinations (2.7%), Necessary drug omitted (25.2%), More efficient drug exist (6.9%) Drug no indicated (16.2%) Degree of acceptance by physicians has been, so far of the 62%.

Conclusion: To make conciliation and revision at the same time at the admission makes more efficient the work of the Consultant Pharmacist. It also provides the patient since the beginning of the stay in the nursing home with a medication plan appropriate to his/her present health

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situation and revised of errors. It has been easier to obtain back up from the clinicians, than when the review is done time after the admission.

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6-097

Category: Geriatrics

Title: Implementation of a medication reconciliation plan at admission in two long-term care settings

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Purpose: Review and reconcile the medication of the patients admitted in our long term care centers and guarantee the administration of the appropriate medication and the correct dose at the suitable moment, preventing omissions, duplications, wrong doses or pharmacological interactions. Reduce the risks of medication errors due to transitions between different health care levels. Give pharmaceutical care focused on the person, a drug management for each patient, and resolve doubts about the treatments raised by the staff and the patients.

Methods: A prospective study was completed over a seven month period, from October 2013 to April 2014 in two long-term care centers. One center is located in Barcelona (152 beds) and the other one is in Girona (97 beds). All the patients admitted during this period were included in the study, except those of the Palliative Care Unit. Previously, a protocol of medication reconciliation at the admission was developed by consensus between pharmacists and clinicians. The reconciliation process begins with a revision of medication done by the pharmacists at the moment of the admission. The aim is to detect discrepancies and medication errors. The sources of information used to obtain the updated drug treatment are: the prescription done at the admission, previous discharge reports and controls (HC3: Electronic Shared Medical Record of Catalonia), the medical history and an interview with the patient. We notify the problems and discrepancies to the clinician during the first 48 hours after the admission. Acceptance or refusal of the recommendations suggested and the reason given by the doctor are recorded.

Results: Of all the patients admitted with the criteria for medication reconciliation (576), this was performed in 456 patients (79.1%), with an average age of (80.89 10.32) years, 65.63% were female and 34.38%. In a 29.82% of patients we found discrepancies with an average of 1.58 discrepancies per patient. Of the 215 discrepancies were detected 61.86% were justified by (therapeutic interchange and medication discontinuation) and 38.14% were not justified. Of the unjustified discrepancies (reconciliation errors), the medical staff accepted the recommendations of pharmacists in a percentage of 73.17%. The types of unjustified discrepancies detected were: omission (63.41%), wrong dose (19.51%), duplications (6.10%), wrong medication and wrong route of administration (4.88%) and wrong frequency of administration (1.22%). 24.65% were cardiovascular drugs, 18.60% corresponded to digestive system and metabolism, and 18.14% to central nervous system.

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Conclusion: Medication reconciliation at admission allows us to identify medication errors that can be missed. The complicated typology of patients admitted in long-term care settings, makes the process especially complex but it is the main reason to have an updated drug treatment. Medication reconciliation guarantees us a continuous health care assistance and an improvement in the medication safety for the patients admitted in our centers. This is a complicated process that demands an important dedication of time by specialized pharmacists, because they have to review diverse and not standardized documents, with omissions and incomplete information.

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6-098

Category: Geriatrics

Title: Pharmacist consult service in geriatric trauma patients in a large academic medical center

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Purpose: Geriatric patients have multiple co-morbid conditions that are treated with various medications, which predispose them for traumatic injuries. The Trauma Program at Jefferson University Hospital (JUH) created a pilot program to improve care for geriatric patients that included consultative services from an interprofessional group of practitioners, including evaluation of medication therapy by pharmacists. The purpose of this study is to describe a process utilized for the pharmacists role as participants of an interprofessional team in addressing medication safety in geriatric patients admitted for trauma. It is hypothesized that pharmacist consultation and intervention had a positive impact on geriatric trauma program.

Methods: Patients 65 years old and greater admitted to the trauma service at JUH identified through an internal trauma registry database were included for review. These patients were identified daily Monday thru Friday and were included if they were on greater than five medications upon admission, average medication change of six or greater since admission, recent hospitalization within the past 30 days, or history of fall. A pharmacist would review the patient within 72 hours of identification and/or consult order. The pharmacists utilized both the Screening Tool for Older Persons Prescriptions (STOPP) as well as the American Geriatrics Society endorsed Beers 2012 List in assessing potentially inappropriate medications (PIMs) in this population. During the consult process, the following data was collected: patient demographics, admission diagnosis, previous medical history (PMH), medication reconciliation, living situation, laboratory values, and PIMs. The assessment and recommendations were communicated via a consult note in writing as well as verbally to the trauma service. Data was analyzed to determine if the patients trauma was caused and/or exacerbated by medications and documented in pharmacy intervention program Senti7 by Pharmacy OneSource. Acceptance of pharmacists recommendations was reviewed after discharge process and these patients were followed for related 30-day readmission.

Results: There were a total of 349 patients in the trauma registry that were admitted on various inpatient surgical (trauma, orthopedic, neurosurgery) as well as medical services from February 15, 2013 to May 15, 2014. A total of 267 (56% female) patients with an average age of 82 years were reviewed by pharmacists as part of the consult process. Of these, 214 (80%) patients admitted for an injury were community-dwelling elders, who had falls (235, 88%), and 26

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(9.8%) for motor vehicle collision. The compliance of initial review/consult process within 72 hours was met in majority of the patients (239, 90%). The trauma registry identified 235 (66%) patients admitted for an injury were on antithrombotic medications at admission, however, not all of them experienced hemorrhage. Psychotropic medications were most commonly used in this population (126 of 267 patients, 47%), which were correctly identified by both Beers 2012 and STOPP criteria. However, falls related to antihypertensive medications found in 57 of 267 (21%) and fractures related to the use of proton pump inhibitors were missed by both of these tools. Only five patients were readmitted within 30 days of discharge of their initial trauma, with two of them being medication related.

Conclusion: Majority of the patients were part of the pharmacist consult were community-dwelling elders admitted for injury related to their fall. Although the causes of falls in these patients are multifactorial, medications played an important role in addition their physical condition and nutritional status. Pharmacists were one of the groups of consultants as part of the total care program in addition to nurses, clinical dietitians, occupational/physical therapists, and geriatricians. Overall, there was a positive impact of the pharmacist consult service on the geriatric trauma program especially identification of PIMs included in Beers 2012 and STOPP as well as outside these criteria.

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6-099

Category: I.V. Therapy / Infusion Devices

Title: Implementation of rituximab administration worksheet for nursing to program infusion pumps in outpatient oncology centers

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Purpose: The avoidance of administration errors with chemotherapy is an important part of medication safety initiatives. Rituximab administration errors were identified through infusion pump alert reports. The computerized physician order entry (CPOE) system and the infusion pump support only an infusion rate (mL/hr) for rituximab orders. Rituximab has dose-rate (mg/hr) infusion parameters on order sets. Nursing had to calculate the infusion rate (mL/hr) and volume for each step-wise dose increase causing pump alerts. This project was designed to correct the rituximab administration errors during pump programming in the outpatient oncology infusion centers.

Methods: The infusion-pump pharmacist developed an Excel-based spreadsheet for the outpatient oncology pharmacists to enter rituximab information: oncology order set name, drug dose, drug volume, bag volume, and bag overfill volume. The spreadsheet performed calculations and made an administration worksheet. Nursing used this printed administration worksheet to program the pump with the infusion rate (mL/hr) and volume for each step-wise dose increase. Rituximab infusion alerts were tracked over a 3 month period.

Results: The outpatient oncology pharmacists tested the spreadsheet for accuracy over a four week period and provided feedback for programming changes. Several enhancements were made to calculate the administration directions and the addition of a pharmacist signature/date field. Nursing trialed the administration worksheet over a two week period and noted a minor revision for a specific order set. Rituximab infusion alerts decreased 43 percent from baseline over 3 months.

Conclusion: The electronic pharmacy calculation spreadsheet and printed administration directions reduced rituximab infusion errors during pump programming.

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6-100

Category: I.V. Therapy / Infusion Devices

Title: Sterility of extended administration with continuous infusion compounded preparations in a pediatric intensive care unit

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Purpose: Discrepancy exists in the maximum administration time of continuous infusion compounded sterile preparations (CSPs). USP <797> recommends a maximum of 48 hours at room temperature between compounding and administration for low-risk products; however, it does not provide guidance on maximum IV infusion duration. The CDC recommends 72 hour IV administration set changes to minimize line manipulations. This leads to discordance between drug product beyond-use-dating (BUD) and IV administration set changes. The purpose of this study is to determine sterility of continuous infusions when using 48 hour BUD as a hang-by time.

Methods: A three-month pilot study was conducted between June and September 2013 for pediatric ICU patients receiving CSPs via continuous infusions. All CSPs were required to be initiated prior to the BUD and could be administered until the next IV administration set change. Because of mandatory administration set changes every 72-hours, CSPs could be administered for a maximum of 120 hours. Medications with known stability/sterility issues preventing prolonged infusions (eg. insulin/propofol) were excluded. During administration set changes, CSPs were immediately removed by nursing staff using sterile technique and frozen. At the time of testing CSPs were thawed and filtered via individually-sealed, pre-sterilized funnels with 0.2 micron filters within a vertical laminar airflow hood. The filters were then placed on Mueller Hinton agar plates and incubated at 35°C for 48 hours. Bacterial colonies were quantified and compared to the filtered volume for each sample to determine CFU/mL burden. Staphylococcus aureus was used as a positive control for the filtration/culture process. CSPs completed within 48 hours of preparation time were considered to be the control group while those beyond this time served as the intervention group. Matrix-assisted laser desorption/ionization time of flight mass-spectrometry (MALDI-TOF) was used for identification of positive cultures.

Results: A total of 126 CSPs were collected during the study timeframe. Of this, 9 were excluded due to: unknown specific preparation time (n = 5), sample without syringe cap after use that may compromise sterility (n = 2), undocumented frozen time (n = 1), and known contamination during agar plating (n = 1). Of the 117 samples, 56 served as control (≤ 48 h) and 61 as intervention (>48 h). The mean difference between prepared time and frozen time was 28.7 9.9 hours (range: 6.3 to 47.3 hours) for the control group and 87.9 32.8 hours (range: 48.8 to

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172.7 hours) for the intervention group. A total of 2 samples (3.6%) in the control and 3 (4.9%) in the intervention were positive for bacterial growth. Seven different types of bacterial isolates were identified. The only potential pathogen isolated was *Staphylococcus epidermidis*, which was present in two samples in the intervention group at concentrations less than 0.02 CFU/ mL. Due to the low concentration, these contaminants may not be clinically significant.

Conclusion: A similar contamination rate for continuous infusion CSPs was observed for those discontinued prior to the BUD and those administered past the BUD up to 120 hours in this pilot study. Additionally, the rate was similar to past studies assessing contamination from preparation alone which has been estimated to be approximately 5%. Future studies with larger sample sizes may provide additional reassurance for using BUDs as hang-by times.

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6-101

Category: I.V. Therapy / Infusion Devices

Title: Pharmacy based preparation and stability of ready-to-administer epinephrine injection solution (0.02 mg/mL, 50 mL)

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Purpose: In the University Medical Center Mainz standardized concentrations are determined for all medicinal products that are administered by continuous injection in adult intensive care patients. A number of the ready-to-administer products are aseptically prepared in the hospital pharmacy department. The aim of this project was to test the feasibility of batch-wise semi-automated aseptic preparation of epinephrine injection solutions 0.02 mg/mL in 50 mL plastic syringes and to validate the analytical methods for quality control and stability testing of the finished product.

Methods: Bulk solution containing epinephrine hydrochloride 20 g/mL (batch size 80 syringes = 4 L) was prepared in a closed procedure by dilution of licensed epinephrine 25 mg/25 mL (concentration 1 mg/mL) injection concentrate. The calculated amounts of the injection concentrate and 5% glucose infusion solution are mixed in empty infusion bags (PP/PE) by using a compounder. The admixed epinephrine injection solution is aseptically filled with a four-channel-syringe pump into lightproof 50 mL syringes as primary containers and closed with stoppers. The syringes are semi-automatically labelled and stored at 2-8 degree Celsius. Microbiological quality of the aseptic preparation procedure is assured by environmental monitoring and media fills. Samples of each batch are withdrawn for sterility tests and measurement of the epinephrine concentration. Therefore a HPLC assay with UV detection and an innovative Nucleodur sulfonyl group HPLC column was implemented and validated. Stability tests were performed with the same assay.

Results: During a three month period the ready-to-administer epinephrine injection solution 0.02 mg/mL, 50 mL was prepared and tested. The semi-automated procedure revealed to be adequate in order to prepare the ready-to-use syringes complying with the specifications set. The preparation of one batch i.e. 80 syringes takes one hour. During the stability tests the concentration of epinephrine remained unchanged over a period of three months. After four and twelve weeks storage under refrigeration the epinephrine concentration amounted to 100.6% and 100.7% of the nominal concentration, respectively. Neither adrenochrome (detection wavelength 480 nm) nor any other degradation product was detected during the study period. Through the physicochemical stability the production of the ready-to-use epinephrine injection solution for stock is feasible in the hospital pharmacy department, time-saving in the intensive care units, and ensuring patient safety.

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Conclusion: The batch-wise aseptic preparation of epinephrine injection solution 0.02 mg/mL, 50 mL as well as adequate quality control measures and batch release are feasible in an efficient manner in the hospital pharmacy department. Physicochemical stability is given over at least three months under refrigerated storage conditions. Thereby batch-wise preparation for stock is feasible. The accurate, safe and stockable ready-to-administer products are highly appreciated by doctors and nurses.

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6-102

Category: I.V. Therapy / Infusion Devices

Title: Development and Evaluation of computerized prescription support system of diluting solutions for frequently used or continuously infused injections in Neonatal Intensive Care Unit

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Purpose: Critically ill newborns in neonatal intensive care units (NICUs) are particularly at risk for medication errors. Computerized physician order entry systems (CPOE) had been developed to reduce the medication errors, but there were no recommendation options for appropriate type and amount of diluting solution for injectable drugs prescribed in neonatal patients. We have developed the computerized prescription support system of diluting solutions for frequently used or continuously infused injections in NICU which links the CPOE system since May 2011, and evaluated the effects on reduction of medication errors occurring in the process of diluting drugs.

Methods: On the basis of references to the literature with consultation of medical staffs, the database for prescription support system was configured about the type and amount of diluting solutions for a total of 54 components of injection drugs. When the prescribed drug dosing is automatically calculated in accordance with CPOE, the type and volume of fluids for dilution had been entered automatically right below the medications. During the baseline period (January 2010 to September 2012), we compared the incidence of medication errors about the dilution of injectable drugs between pre- and post- application of the system.

Results: Among the total 60,424 cases of ordered medication, the number of errors about dilution was 375(0.62%). Errors associated with the wrong type of diluting fluid are 174 cases, and 201 cases were caused by the miscalculated concentration. Of these errors, comparing with the pre-application of this program (151 cases (0.5%) of type error, 165 cases (0.55%) of concentration error) and post-application (23 cases (0.08%) of type error, 36 cases (0.12%) of concentration error), the incidence of the medication errors regarding the diluting drugs had significantly reduced($p < 0.001$).

Conclusion: Based on these results, computerized prescription support system of diluting solution had made easy in ordering diluting fluids with drug, as well as contributed to a safe and effective medication use.

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6-103

Category: Infectious Diseases

Title: Assessment of antibiotic utilization in asthmatic Lebanese inpatients

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Purpose: Asthma is a chronic inflammatory disease which is characterized by airway hyper responsiveness. Management of asthma attack is a challenge because several factors underlie behind its etiology. International treatment guideline doesn't support the use of antibiotic in asthma attack except if a documented source of infection is localized. Despite the recommendations, management of asthma exacerbations is still identified as a source of unnecessary antibiotic prescriptions. The inappropriate utilization of antibiotics in all diseases and mainly asthmatic patients intensifies resistance to therapy. This study was conducted to assess the use of antibiotics in acute asthma attack management in the Lebanese population.

Methods: This was a retrospective, observational, single center study conducted at a Lebanese teaching hospital from March till April 2014. Data was collected from computerized data bases for hospitalized patients who had asthma exacerbation from February till April 2013. Patient variables were recorded including age, gender, asthma stage, administered antibiotic, signs and symptoms of infection. All patients hospitalized for an acute asthma exacerbation were eligible for study enrollment. Patients were excluded from the study if they were immunocompromised or had concomitant lung disorder as tuberculosis, malignancies, pulmonary fibrosis, or sarcoidosis. Infectious origin was justified if signs and symptoms along with the chest X-ray, white blood cell count, fever and culture were documented. The Institutional Review Board (IRB) approved the study design. Data was analyzed by the SPSS version 20.0 and presented as frequency/percentage and mean standard deviation (SD).

Results: From a total of 841 patients screened for eligibility, only 80 met the inclusion criteria and were enrolled in the study. From the enrolled participants, only forty-eight (60%) were prescribed antibiotics for the management of the acute asthma attack. From those patients who were on antibiotics, 28 (58.3%) had diagnostic criteria supported the therapy for the infectious source where as 20 (41.7%) were treated with antibiotics without clear justification. In patients who met the diagnostic criteria, 93 % were reported with leukocytosis, 39% consolidation on the chest X-ray, and 4% positive culture. The same diagnostic criteria as white blood cell, chest X-rays, and culture were all negative in the other group. The prescribed antibiotics in the inappropriate group were B-lactams 50%, macrolides 40%, and respiratory fluoroquinolones 10%.

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Conclusion: This study demonstrates that in the Lebanese setting, asthmatic patients are receiving antibiotics without clinical infectious origin. Hence, guiding clinicians regarding appropriate prescription of antibiotics in all asthmatic patients is vital to achieve compliance with the consensus guidelines. The role of clinical pharmacist may facilitate this process across all antimicrobial classes through interventions that should be implemented to raise the awareness for all admitted patients.

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6-104

Category: Infectious Diseases

Title: Assessing the success of enhanced anti-retroviral computerized order sets in reducing the number of anti-retroviral pharmacist interventions

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Purpose: Anti-retroviral stewardship is an integral but often neglected component of antibiotic stewardship. In April 2011, the established Antibiotic Stewardship program was expanded to include an anti-retroviral segment at a tertiary-care metropolitan hospital. Review of the intervention data resulted in implementation of enhanced order sets in the hospitals computerized order entry system (QuadraMed) in June 2013 to guide physicians in the appropriate ordering of anti-retrovirals. Concomitant case-based pharmacist education modules were conducted to help staff pharmacists identify incomplete regimens, inappropriate dosing, and drug-interactions. In this study we evaluated the impact of enhanced order sets on the number of interventions required.

Methods: An infectious disease trained pharmacist created an anti-retroviral data base of all patients on highly active anti-retroviral therapy (HAART) and documented the regimens. The total number of unique patients reviewed on HAART and ritonavir were tallied from January 2012 through March 2014. As ritonavir was deemed to be the most inappropriately prescribed anti-retroviral, data specific to ritonavir was analyzed. A review of the pharmacy departments anti-retroviral interventions was conducted for the same time period. No data was collected from 3rd quarter 2012 through the 2nd quarter 2013 due to closing of the hospital during and after Hurricane Sandy. HAART and ritonavir interventions were categorized by quarter. All ritonavir interventions were separately categorized as follows: inappropriate dose, incomplete regimen, duplication of therapy, order clarification, and others. The number of patients on HAART, number of interventions, and types of ritonavir interventions January 2012 through June 2013 (pre-intervention) and after June 2013 (post intervention) was compared.

Results: After implementing enhanced order sets, the overall number of interventions per quarter decreased by approximately 45% (range 37% to 50%). The number of ritonavir interventions decreased on average by 54% (range 43% to 60%). The percentage of patients requiring interventions decreased by approximately 38.8%; from a baseline of 34.8% (range 32% to 37%) to 21.3% (19 to 25%). The type of ritonavir interventions varied from quarter to quarter. The number of inpatients receiving HAART decreased by 11.7% (averaging all quarters); from the pre- to the post- intervention period.

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Conclusion: Enhanced anti-retroviral order sets reduced the overall number of anti-retroviral interventions. This does not seem to be due to a lower volume of patients receiving anti-retrovirals. This modality was effective in improving prescribing of anti-retrovirals and reducing the need for pharmacist interventions.

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6-105

Category: Infectious Diseases

Title: Probenecid as adjunctive therapy with nafcillin for the treatment of persistent methicillin-sensitive staphylococcus aureus endocarditis

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Case Report

Purpose: The following case report describes the adjunctive use of oral probenecid with nafcillin for the treatment of methicillin-sensitive *Staphylococcus aureus* (MSSA) endocarditis. A twenty-six year old female with a past medical history of intravenous drug abuse and infective endocarditis with vegetation on the tricuspid valve presented to the emergency room with a drug overdose. Her urine drug screen was positive for cocaine and opiates, she was found to have right sided hemiparesis, aphasia, and an altered mental status. The patient was then admitted to the neurology intensive care unit for cerebral vascular accident secondary to septic emboli. After blood cultures were obtained, intravenous vancomycin and cefepime were started and an infectious disease consult was requested due to the patients infectious history of methicillin-resistant *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Enterobacter asburiae*. A transthoracic echocardiogram and transesophageal echocardiogram further revealed vegetation on both the mitral and tricuspid valves. Initial blood culture results revealed gram positive cocci, and vancomycin with cefepime was continued. On day three, all four blood cultures were positive for MSSA as antimicrobial therapy was narrowed to intravenous nafcillin with gentamicin. On day seven the infectious disease physician consulted pharmacy to discuss the case and treatment options for this patient with persistently positive blood cultures, with six out of six blood cultures yielding MSSA despite a regimen of maximum daily dose nafcillin with gentamicin. After pharmacy consultation, oral probenecid 500 milligrams four times daily was prescribed to decrease elimination of nafcillin in this young patient with likely enhanced drug excretion. Forty-eight hours later, blood cultures were obtained and subsequently revealed no growth as the patients clinical condition improved. The patient continued therapy for an additional four weeks with probenecid as adjunct to nafcillin therapy, and was subsequently discharged home to follow-up with the infectious disease physician. Probenecid is typically used as a treatment option for hyperuricemia in gout. It was developed to enhance the effectiveness of antibiotics by decreasing their elimination, prolonging the half-life, and augmenting serum drug levels in patients. Revisiting former treatment options has become necessary to enhance or replace antibiotics when encountered with barriers to treatment success. This case provides an

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example where probenecid was used as an adjunct therapy with nafcillin to effectively treat persistent MSSA endocarditis.

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6-106

Category: Infectious Diseases

Title: Acyclovir neurotoxicity vs. worsening encephalitis followed by nephrotoxicity

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Case Report

Purpose: This case report illustrates the potential of neurotoxicity and acute renal failure secondary to administration of intravenous acyclovir. This is an 88 year old male who was brought to the emergency room (ER) by his family for increasing confusion, bilateral lower extremity weakness, difficulty ambulating and fever. He underwent an MRI of the brain that demonstrated a hyperintensity T2 signal in the right medial temporal lobe. Differential diagnosis included herpes encephalitis vs. limbic encephalitis vs. neoplasm. Patient underwent a lumbar puncture which demonstrated a positive HSV-1 PCR of the spinal fluid. Thus, patient was diagnosed with herpes simplex type 1 (HSV 1) encephalitis. Patient was initiated on acyclovir 10 mg/kg IV every 8 hours. The dosing interval was subsequently increased to every 12 hours based on renal function. The patients renal function improved and acyclovir dosing interval was increased to every 8 hours. The patients mental status improved significantly and was discharged home on a 2 week course of IV acyclovir 10 mg/kg every 8 hours. The patient returned to the ER 3 days after hospital discharge with increasing confusion, poor oral intake, and generalized malaise. In the ER, the patients kidney function was normal (SCr 1.1. mg/dL). It was felt that the patient had persistent encephalitis due to HSV-1 and the acyclovir was continued at the current dose and interval. Due to the increased confusion and lethargy the patient was admitted to a nursing facility. Over the next 48 hours the patients mental status continued to decline along with decreased oral intake. The patient was brought back to the ER 48 hours after his last ER visit. Labs revealed an elevated SCr of 4.2 mg/dL. The patient was given a dose of acyclovir in the ER prior to hospital admission. Repeat head CT revealed no acute intracranial abnormalities. Neurology, nephrology and infectious disease (ID) consults were obtained. Neurology recommended that the acyclovir be discontinued since the patient had completed a 14 day course for HSV-1 encephalitis. Neurology also noted that if the patients mental status did not improve with renal failure improvement that an EEG or repeat MRI be considered. Nephrology stated that the acute renal failure was likely secondary to poor oral intake and confusion which likely resulted from the acyclovir although dehydration likely contributed as well. They also noted that the patients encephalitis deteriorated prior to the acute renal failure so nephrotoxicity was not likely the cause of the altered mental status. ID consult noted that the acute renal failure is likely secondary to the acyclovir as a result of acyclovir crystallization in the renal tubules. ID recommended to discontinue the acyclovir as the drug is likely still present with the degree of renal impairment. If antiviral therapy is to be continued, valacyclovir will be initiated. Acyclovir was discontinued on the suspicion of nephrotoxicity (and likely neurotoxicity). Additional antiviral therapy was never restarted as it was felt that the patient received an adequate course of therapy for the HSV-1 encephalitis and the patient continued to improve. The patients mental status and serum creatinine returned to baseline and he was discharged home. Acyclovir is

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associated with neurotoxicity and nephrotoxicity. The temporal relationship between acyclovir therapy and the onset of adverse effects suggest acyclovir as the cause of this patients nephrotoxicity and a proposed cause of the neurotoxicity. Worsening encephalitis in patients receiving acyclovir must be investigated thoroughly to distinguish between disease worsening and acyclovir toxicity. Early recognition is critical as continued acyclovir therapy can lead to worsening and new adverse effects as was the case in the patient.

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6-107

Category: Infectious Diseases

Title: Antibiotic association and clinical risk factors for healthcare facility associated Clostridium difficile infection

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Purpose: The incidence and severity of Clostridium difficile infection (CDI) has increased recently. Antimicrobial misuse may contribute to increased rates of CDI, which places an economic burden on healthcare facilities. The aim of this study was to identify clinical risk factors and antibiotic regimens associated with healthcare facility associated CDI. This analysis will allow our facility to implement an effective antibiotic stewardship program to lower the incidence and severity of CDI.

Methods: The institutional review board approved this retrospective chart review. The study population included all patients who had a positive C. difficile stool culture from July 2011 to August 2013 at a community hospital. Patients were included in this study if they were greater than 18 years of age with a positive stool after 48 hours of hospital admission. Patients who stayed in the hospital less than 48 hours or were admitted with a primary diagnosis of CDI were excluded. All patient data was harvested from electronic medical records. Data was collected and verified by two pharmacists. Data points collected included disease severity, race, sex, age, weight, length of stay, baseline serum creatinine, albumin, white blood cell count, antibiotic regimens, probiotic use, and gastric acid suppressant use. All data was entered into a standardized excel spreadsheet for analysis. Hospital wide CDI rates were calculated using the number of case patients per month per 10,000 patient days.

Results: Of 62 patients with healthcare facility associated CDI, all patients received antibiotics during their hospital admission. Within the study population the incidence of CDI was increased in patients who were greater than 65 years of age; treated with agents inducing gastric acid suppression, and had hypoalbuminemia. The highest risk antibiotics associated with acquiring healthcare facility associated CDI were: broad spectrum penicillins (zosyn $p < 0.001$), ciprofloxacin ($p < 0.001$), vancomycin ($p < 0.001$), azithromycin ($p = 0.003$), imipenem ($p < 0.001$), and cephalosporins (ceftriaxone $p = 0.001$; cefazolin $p = 0.005$). CDI incidence rate per 10000 patient days was also calculated and measured over the time period of the study. No significant trend was seen in the CDI incidence rate per month during the study period.

Conclusion: The clinical risk for acquiring healthcare facility associated CDI was increased in elderly patients, those with lower albumin levels, and those receiving gastric suppression agents. Patients receiving broad spectrum antibiotics had a higher risk of CDI. There were no clear trends in CDI rates over the period studied as the rate of infection varied from month to month.

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The results of this study can be used as a guide in developing antimicrobial stewardship practices in our facility for broad spectrum antibiotics.

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Professional Poster Abstract

6-108

Category: Infectious Diseases

Title: Clinical surveillance and rapid diagnostic testing to aid with antimicrobial stewardship in a community hospital

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Purpose: Clinical decision support technology is becoming increasingly common to help facilitate optimal antimicrobial stewardship practices. This technology often takes antiquated manual processes and transforms them into more efficient clinical activities. Rapid diagnostic testing can greatly affect the amount of time it takes the pharmacy to ensure the correct antibiotic for the specified organism. However, the information gained from this type of testing is only as valuable as the program in place to perform the necessary interventions with the results. Combining an effective clinical surveillance system with the use of rapid diagnostic testing can lead to a streamlined approach to identify patients for possible intervention, as well as open communication among the pharmacy staff.

Methods: The antimicrobial stewardship committee, at a community hospital, deployed the use of rapid diagnostic testing (PNA FISH) and a clinical surveillance system (Sentri7). Pharmacy worked closely with the microbiology department to develop how the PNA FISH results would be reported. It was determined that free text could be added to the reported results that include local antibiogram statistics, as well as suggested actions to perform with the results. For example, if the PNA FISH identified *Klebsiella pneumoniae* as the potential organism then the suggested action would be De-escalate from broad-spectrum or anti-pseudomonal antibiotics. Consider ampicillin/sulbactam (85% susceptible 2013 antibiogram), cefazolin (95% susceptible 2013 antibiogram), ceftriaxone (95% susceptible 2013 antibiogram). A real-time alert was then constructed within Sentri7 to find patients with a PNA FISH result. Once a PNA FISH result and suggested action are generated, a pharmacist reviews pertinent patient clinical information and determines if a change in therapy is needed. The change in therapy is then documented as an intervention within Sentri7. If no change was made, a follow-up is entered within Sentri7 to continue to follow the patient for final culture results. This allows the pharmacist to monitor these patients throughout the stay.

Results: The implementation of clinical decision support technology led to improved efficiencies related to antimicrobial stewardship clinical activities. This particular combination of technologies led to a streamlined approach for guiding empiric antimicrobial therapy. The suggested action within the PNA FISH resulted in consistent recommendations made by clinical staff. The identification and documentation within Sentri7 provided a mechanism to track recommendations and follow-up on patients where susceptibilities were needed prior to

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intervention. These technology changes, in addition to the other antimicrobial stewardship initiatives currently deployed, were responsible for a decrease in antibiotic costs over the past three years. From 2011 to 2014, the average antibiotic cost per patient day decreased from \$9.69 to \$7.67.

Conclusion: The addition of PNA FISH for rapid detection was targeted as a component of the antimicrobial stewardship program. Due to staffing challenges, a need was identified to help optimize the use of PNA FISH. Senti7 helped drive an efficient process to quickly act upon the PNA FISH results. The antimicrobial stewardship team is exploring using Senti7 real time email notifications to optimize the process even further.

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Professional Poster Abstract

6-109

Category: Infectious Diseases

Title: Assessment of vancomycin utilization in Lebanese hospitals

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Purpose: Vancomycin is a glycopeptide antibiotic that has been in clinical use for long term duration. It is the cornerstone for the treatment of methicillin-resistant *Staphylococcus aureus* (MRSA). The use of Vancomycin possesses several limitations and one of these is the requirement for monitoring to minimize side effects and ensure efficacy. Various therapeutic guidelines were published that contribute to the current knowledge about monitoring patients on Vancomycin. But as a practical method, trough serum vancomycin concentrations are considered the most accurate method for monitoring effectiveness. The purpose of this study is to assess Vancomycin utilization in Lebanese hospitals through an evaluation of the monitoring practice and determine if the weight-based dosing regimen is implemented.

Methods: This was a retrospective, observational, multicenter study conducted at Lebanese hospitals from February till April 2014. Data was collected from computerized data bases for hospitalized patients on Vancomycin from January 2010 till December 2013. The following patient variables were recorded age, gender, weight, creatinine clearance, vancomycin dose, trough levels, and indication for Vancomycin therapy. Patients above eighteen years old and treated with parenteral Vancomycin for more than three days were eligible for study enrollment. Excluded were patients younger than eighteen years of age or with a *Clostridium difficile* infection. The Institutional Review Board (IRB) of the involved centers approved the study design. Data was analyzed by the SPSS version 20.0 and presented as frequency/percentage and mean standard deviation (SD) to illustrate current prescribing practices.

Results: A total of 250 patients were initially screened where only 120 patients met the inclusion criteria and enrolled in the study. Based on actual body weight, only 11 out of 120 patients (9.16%) were taking the suitable dose with a mean (+/- standard deviation in mg/Kg) of 19.24 +/- 2.81 for the weight category between 30 and 60 Kg. From the enrolled patients, only 67 (58.33%) were monitored for trough concentration measurements. Patients who had the appropriate target trough levels between 15 and 20 were only 20 (29.9%). The others had their trough concentration either below 15 (41.8%) or more than 20 (28.4%). From the patients who had the target trough, only eight were given the recommended dose between 15 and 20 mg/Kg. The mean trough levels (+/- standard deviation) were 20.74 +/- 9.10 for sepsis, 14.85 +/- 4.35 for pneumonia, and 15.12 +/- 5.26 for skin and soft tissue infections.

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Conclusion: Vancomycin adequate dosing and monitoring of serum concentrations are necessary to maximize efficacy, minimize toxicity, and reduce the emergence of resistance. This study demonstrates that in Lebanese hospitals Vancomycin dose is inappropriate in the majority of patients. Hence, guiding clinicians regarding appropriate Vancomycin dosing and recommended target trough levels are vital to achieve compliance with the consensus guidelines. The role of clinical pharmacist may facilitate this process across all patients through interventions that should be implemented to raise the awareness.

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Professional Poster Abstract

6-110

Category: Infectious Diseases

Title: Dermatologic infection of lower limbs caused by pseudomonas aeruginosa

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Case Report

Purpose: This case report illustrates the risk of the dermatologic manifestation of pseudomonas aeruginosa in an outpatient setting. The patient is a 21 years old female, who presented with typical pustules on her lower legs that have the prototype of a staphylococcus aureus infection. The patient was living in the Kingdom of Saudi Arabia (KSA) for 19 years, who then moved to Lebanon for college and work. She stated visiting her parents twice during the past year in KSA. After returning back to Lebanon from both trips, her lower limbs showed a typical presentation of a gram positive dermatologic infection that was accompanied by a stinging feeling, pruritis, fatigue, and inability to walk. After the first manifestation, she was prescribed a first generation cephalosporin: cefadroxil 500 mg orally twice daily, to treat the suspected causative staphylococcus aureus infection, and a first generation antihistamine: hydroxyzine 10 mg orally twice daily, to alleviate the symptoms of itching. After adhering to the treatment for ten days, the patient reported a slight improvement, and confirmed absence of symptoms at day fourteen. The second episode occurred after her second visit, where she re-experienced the same symptoms, and she self medicated herself by repeating the same regimen for 10 days, but no improvement was noted this time. So for this reason, she sought the help of a clinical community pharmacist, who asked for a culture and an antibiogram after taking a full history from the patient. The culture was positive for pseudomonas aeruginosa which was sensitive to the following antibiotics: amikacin, gentamycin, tobramycin, carbenicillin, piperacillin, piperacillin plus tazobactam, imipenem plus cilastatin, cefepime, ceftazidime, ciprofloxacin, levofloxacin, norfloxacin, and aztreonam. Thus, the patient was prescribed ciprofloxacin 500 mg orally twice daily for fourteen days along with desloratadine 5 mg orally once daily for pruritus. After having finished the antibiotic course, the patient reported full healing, absence of symptoms, and ability to walk normally again. After extensive questioning about her past medical, social, and family history, the young lady reported that both of her parents work at a medical center, and she used to share her mothers clothes. Upon further analysis, it has been hypothesized that the source of the infection might be the colonization of pseudomonas aeruginosa from the mothers work environment, which lead to the transmission of the pathogen through the clothes from the mother to the daughter.

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6-111

Category: Infectious Diseases

Title: Assessment and outcomes of intravenous to oral antibiotic switch at three Lebanese university hospitals

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Purpose: Hospitalized patients are initially prescribed intravenous (IV) antibiotics as an empiric treatment for most infections. Most of those patients can be safely switched to oral (po) antibiotics within the third day of hospital admission once clinical stability is established. This study was conducted to assess the utilization of IV antibiotic therapy through an evaluation of the switch to po based on predefined eligibility criteria and to correlate the outcomes with regard to length of IV antimicrobial therapy and length of hospital stay.

Methods: This was a retrospective observational study conducted in three Lebanese university hospitals over a period of six months. Institutional Review Board approval was obtained from the involved centers. Patients admitted to the internal medicine ward and diagnosed with infectious origin were screened. Patient demographics, medication history, vital signs, microbiological laboratory results and white blood cell count were obtained from the medical records. Out of 2073 total admissions, 383 adult patients treated with 491 IV antibiotic courses and fulfilled both inclusion and exclusion criteria previously set were enrolled in the study. Patients were screened for the appropriate switch from IV to po antibiotic therapy if the clinical improvement was established. Students t-test and Chi square test used for statistical analysis. All reported p-values were two-sided with the alpha set at a significance of 0.05.

Results: Thirty-nine (7.9%) episodes were not eligible for the switch and required to continue IV antibiotics. Out of 452 intravenous antibiotic courses and eligible for conversion, only 118 (26.1%) were switched to po treatment and the others maintained on IV antibiotic beyond day 3 with a significant p-value less than 0.0001. The number of days taken for the switch (mean plus minus standard deviation) was 3.81 +/- 1.15 where 111 patients (94.1%) were switched within 3 to 5 days of hospital admission and 7 patients (5.9%) beyond day 5. The mean duration of IV therapy of converted and the nonconverted patients were 2.79 versus 6.61 days respectively with a p-value less than 0.0001. The mean length of hospital stay of converted and the nonconverted patients were 6.29 versus 6.69 days respectively with a p-value of 0.227.

Conclusion: Majority of patients on parenteral antibiotics are suitable for conversion to po therapy once clinical outcomes are documented. The results of the study indicate the need for establishment of an IV to oral conversion program at Lebanese hospitals. This approach is vital in daily clinical practice with the emphasis on the role of clinical pharmacist to review the

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medical records and identify patients who are eligible for therapy conversion. Short courses of IV antibiotic therapy followed by oral medications are beneficial as this decreases the unnecessary prolonged use of parenteral therapy and shortens the duration of hospital stay.

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6-112

Category: Infectious Diseases

Title: Economic impact of a newly created antimicrobial stewardship program

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Purpose: Appropriate antibiotic use is an ongoing struggle in patient treatment. With fewer antimicrobials being developed, it is incumbent for hospitals to use antimicrobials judiciously. A formal antimicrobial stewardship program was created at a community hospital. The goal of this program was to reduce inappropriate antibiotic use, to decrease resistance rates to antibiotics, and to decrease the cost of antimicrobials in the medical center.

Methods: The antimicrobial stewardship program had 2 components. The first component involved a pharmacist reviewing positive culture reports daily Monday through Friday. Prescribers were contacted if antibiotic therapy needed to be changed. The second part of the stewardship program consisted of the development of an antimicrobial stewardship committee. Members of this committee included division of infectious disease, infection control, microbiology and clinical pharmacy. Functions of this committee included formulary recommendations, antibiotic restriction recommendations, and working with microbiology on culture and sensitivity reporting restrictions.

Results: A total of 2106 antimicrobial stewardship interventions were documented from June 2012 to May 2014. Total costs of antibiotic use in the third quarter of 2012, third quarter of 2013 and first quarter of 2014 were \$115,887.51, \$103,820.18 and \$77,240.38, respectively. In relation to weight-adjusted inpatient admissions (WEIPA), the average antibiotic cost per patient in the third quarter of 2012 was \$34.22. In the third quarter of 2013, the average antibiotic cost per patient was \$24.60. In the first quarter of 2014, the average antibiotic cost per patient based on WEIPA was \$19.66. This represents a 42% cost savings, or \$14.56 per patient, when comparing the third quarter of 2012 to the first quarter of 2014. Additionally, since 2012, there has been a reduction in methicillin-resistant staphylococcus aureus (MRSA) and Pseudomonas resistant to ciprofloxacin.

Conclusion: Although there has been an initial trend towards positive microbiology sensitivities, it is difficult to directly correlate this with the antimicrobial stewardship program. However, the formal development of an antimicrobial stewardship program demonstrated a reduction in the cost of antibiotic therapy over a 1.5 year period.

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Category: Infectious Diseases

Title: Development and implementation of tracheitis management guidelines

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Purpose: Management of tracheitis is not well established in the literature. We recognized significant use of inhaled tobramycin for the management of tracheitis, at a significant cost to the health system. The pharmacy department took the initiative to form a multidisciplinary group to develop guidelines for the management of tracheitis.

Methods: A pharmacist reviewed all the literature regarding the diagnosis and management of tracheitis. This information was presented to a multidisciplinary physician group consisting of microbiologists, infectious disease, critical care and pulmonology. Guidelines were developed which included considerations for obtaining a tracheal aspirate, interpretation of gram stain and culture results to discern between colonization and possible infection, and treatment considerations. Draft guidelines were used to conduct a retrospective evaluation of all the patients with tracheostomy tubes during January 2013 to assess the potential impact of our guidelines.

Results: Twenty four patients with endotracheal tube aspirate cultures were reviewed. Sixteen patients received treatment for tracheitis, and only 25% met our criteria for treatment. Ciprofloxacin and inhaled tobramycin were the most common antibiotics utilized. Our retrospective evaluation provided great support for implementing our guidelines system-wide, which was done in November 2013. Although just one marker of appropriate treatment, purchases of inhaled tobramycin have decreased by 67%.

Conclusion: A pharmacist-led guideline development group has been successful in highlighting the issues surrounding tracheitis diagnosis and management, and providing for significant cost savings. Additional outcomes will be assessed to further determine the impact of these guidelines on patient care.

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6-114

Category: Infectious Diseases

Title: Evaluation of variables in a pharmacy managed vancomycin protocol as predictors to achieve optimal trough levels

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Purpose: Therapeutic trough concentrations for vancomycin are generally accepted to be between 10-20 mg/L, while more recently, the optimal range for many patients is now considered to be between 15-20 mg/L. More frequent dosing of vancomycin is warranted to achieve optimal trough levels, particularly for younger patients or those with an increased renal drug clearance. The purpose of this study was to assess the relationship between age, serum creatinine, and body mass index as predictors of the vancomycin trough level within our protocol. Significant findings will be further investigated in order to modify our protocol.

Methods: This study was conducted through a retrospective collection of data from patients on pharmacy managed vancomycin protocol with reported trough levels before the fourth dose. In order to ensure age distribution, we attempted to enroll fifty consecutive patients under and over the age of fifty between February and April 2014. The patient's age, sex, serum creatinine (SCr), body mass index (BMI), inpatient acuity level (critical care versus non-critical care), and the first vancomycin trough level (VTL) were all collected. All patients enrolled were on a pharmacy managed vancomycin protocol where a trough level was obtained within an hour of the fourth dose. Patients who experienced a 50 percent increase in their SCr or documented renal injury after starting vancomycin but prior to the first trough level were excluded. Serum vancomycin concentrations were categorized into subtherapeutic (less than 10 mg/L), therapeutic (10-20 mg/L), optimal (15-20 mg/L), and suprathereapeutic (greater than 20 mg/L). Statistical significance for between group comparisons was determined by chi square test.

Results: A total of ninety-eight patients were enrolled, fifty-four patients over the age of 50 and forty-four patients ages 50 and younger (63 males, 35 females). The average age was 55 years (range 18-91), 39 percent of patients were considered obese (BMI greater than 29.9), and 84 percent of patients were non-critical care. The average SCr at the time of vancomycin protocol initiation was 0.9 mg/dL (range 0.2-2.2 mg/dL), with 41 percent (n equals 40) of patients having a SCr less than 0.8 mg/dL. Analysis of initial VTLs revealed 8 percent (n equals 8) were suprathereapeutic, 22 percent (n equals 22) were optimal, 55 percent (n equals 54) were therapeutic, and 36 percent (n equals 36) were subtherapeutic. Of the 36 subtherapeutic VTLs, 25 of those (69 percent) had a SCr less than 0.8 mg/dL, indicating that patients with a SCr less

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than 0.8 mg/dL were significantly less likely to have an optimal VTL (p equals 0.02). When categorized by age in years, there was a trend towards subtherapeutic VTLs and younger age, with VTLs less than 10 mg/dL found in 67 percent of patients younger than 30, 62 percent younger than 40, and 50 percent younger than 50.

Conclusion: The results suggest that patients with a Scr of less than 0.8 mg/dL were less likely to achieve an initial VTL in the optimal range. The pharmacy managed vancomycin protocol at our institution does not include an every 8 hour dosing option and this frequency is rarely ordered for the initial dosing regimen. A correlation was observed between younger age and subtherapeutic VTLs in our study. These significant findings warrant an amendment to our protocol and further investigation.

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Category: Infectious Diseases

Title: Ten years later: re-assessment of a vancomycin dosing protocol in the treatment of MRSA bacteremia

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Purpose: A vancomycin dosing protocol was developed and implemented at this institution in 2003 to provide a loading dose followed by a maintenance dose of 1000 mg given at a defined interval. Target trough values were 10-20 mcg/ml. Amidst growing concerns regarding clinical efficacy of the dosing protocol and potential for nephrotoxicity, this study was designed to assess the incidence of microbiological cure, rate of nephrotoxicity, and efficacy of the dosing protocol in patients receiving vancomycin for the treatment of MRSA bacteremia.

Methods: This retrospective study included adult patients with confirmed MRSA bacteremia between October 1, 2012 and March 1, 2014. Microbiological cure was defined as the presence of a MRSA-negative blood culture following treatment of a confirmed MRSA-positive blood culture. Nephrotoxicity was defined as an increase in serum creatinine of 0.5 mg/dl or 50%, for at least two consecutive days, from initiation of therapy to 72 hours after the completion of therapy. Vancomycin trough values, MIC data, and inpatient mortality were also evaluated.

Results: Seventy-eight patients were screened, and 50 patients were included in the final analysis. Initial steady-state trough values were within the acceptable range (10-20 mcg/ml) in 74% of cases. The median initial steady-state trough level was 14.8 mcg/ml. Microbiological cure was achieved in 48/50 (96%) of patients. Median time to negative blood culture was 2 days. In addition to bacteremia, 22/50 (44%) of patients had positive MRSA cultures at a concomitant site. Seven patients (14%) had endocarditis. Blood isolates had a vancomycin MIC of 2 mcg/mL in 32/50 (64%) patients. The median duration of hospital stay was 57 days, and inpatient mortality was 12%. Nephrotoxicity developed in 14% of patients. In these patients, median time to nephrotoxicity was 4 days, and vancomycin was prescribed with a median of 3 concomitant nephrotoxic agents.

Conclusion: When used in the treatment of MRSA bacteremia, the vancomycin dosing protocol resulted in a high percentage (96%) of microbiological cure. The exceptions underscored the importance of appropriately managing the source of infection and ensuring appropriate duration of therapy. Vancomycin associated nephrotoxicity was multifactorial with all patients receiving multiple concurrent nephrotoxic agents.

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Professional Poster Abstract

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Category: Investigational Drugs

Title: Development of a novel platform to evaluate compounds targeting FFAR2

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Purpose: Type 2 Diabetes is becoming progressively prevalent in today's population, increasing the need for novel therapies to combat this disease. FFAR2, also known as GPR43, is a G protein coupled receptor that has been implicated in diseases such as T2DM. GPR43 is activated by short chain fatty acids (SCFA). Few chemical drug structures have been identified that selectively activate FFAR2, but not FFAR3, which is also activated by SCFA. Using rational drug design, we set out to explore whether 1) a structure activity relationship could be identified for FFAR2, and 2) if lead compounds would modulate glucose-stimulated insulin secretion (GSIS).

Methods: Compounds: Compounds provided by Dr. Layden (Northwestern University) were reconstituted as 10 mM stocks in DMSO and stored at 4°C. Serial dilutions were made immediately prior to the assay in Hanks balanced salt solution supplemented with 10 mM HEPES (HHBSS). Cell Line: The rodent insulinoma cell line BTC3, expressing the SV40 T-antigen under control of the insulin promoter was used for this study. Cells were maintained in Dulbeccos Modified Essential Medium (DMEM) supplemented with 10% heat-inactivated fetal bovine serum (FBS), and 1X penicillin/streptomycin in an atmosphere of 5% CO₂ at 37°C. Large batches were frozen down, and then vials thawed the day before use and plated in half volume 96-well black plates with clear bottoms using DMEM supplemented with 1% heat-inactivated FBS. Calcium Assays: For the assay, medium was removed and replaced with HHBSS containing 5 mM Cal-520™ (AAT Bioquest), a fluorogenic calcium sensitive dye. Plates were incubated at 37°C for ~60 minutes. Compound plates (10X) were prepared using a 4x dilution series. Plates were brought to room temp, and compounds added to cells using a FLIPR2. Release of intracellular calcium causes an increase in fluorescence. Fluorescence was read at Ex490/Em535 and the max-min data analyzed by nonlinear regression analysis.

Results: The max-min values obtained from independent fluorescent Ca²⁺ assays, each performed in quadruplicate, were averaged and then normalized to the wells with untreated cells. A nonlinear fit equation was used to determine the EC₅₀ and E_{max} values in the case of agonists, or the IC₅₀ and I_{min} values for antagonists. Our results indicate that propionic acid (SCA14) was the compound that had the showed the greatest agonist activity compared to the standards acetic and propionic acid. The EC₅₀ was comparable to that of acetate and propionate; however, the E_{max} of SCA14 was almost twice as high as acetate and nearly 2.5 times higher than propionate. Other studies found that (S)-3-(2-(3-chlorophenyl)acetamido)-4-(4-

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(trifluoromethyl)phenyl) butanoic acid (CATPB) to stimulate the receptor causing an agonist response. While our results demonstrate no agonist activity, it may be due to species differences. The other studies were using human embryonic kidney cells that were transfected with the FFAR2 receptor, while we were using a rodent cell line that endogenously expresses the FFAR2 receptor.

Conclusion: Our results indicate that using the endogenous receptors on pancreatic beta cells, instead of a transfected cell line, may be critical when assessing the pharmacology of these novel compounds. While our results are important, they are only one piece of the puzzle. Calcium accumulation within the cell is only one of the steps in the pathway that results in insulin release from the beta cells. Results from our calcium assay will need to be combined with additional functional assays such as arrestin translocation, beta cell proliferation, and cAMP activity to get a picture of how the compounds alter GSIS.

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Category: Investigational Drugs

Title: Investigational drug implementation into technology systems and medication safety practices across a multispecialty academic center

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Purpose: The Investigational Drug Service (IDS) in a 1,440 bed tertiary hospital has shown to have 308 active research protocols, 863 patients enrolled, and over 4,879 research prescriptions filled annually. High risk exists for medication errors related to potential drug interactions, contraindications, problematic drug names, poor manufacturer labeling, improper administration, randomization errors, and confusion by non-research staff. To address these issues, a workflow process for dispensing and information sharing was developed by IDS with collaboration of informatic and drug information specialists, nursing, and hospital staff to assist with medication safety for inpatients involved in investigational drug trials.

Methods: IDS collaborated with informatic specialists for electronic medical record (EMR) development, reimbursement specialists for billing codes and drug costs, and drug information specialists for drug shortages and formulary management, to create a standard investigational EMR order to be used for inpatient dispensing. Unique nomenclature, billing codes to route dispensing charges to research account activity, specific administration instructions, maximum doses, investigational fields for documentation, drug-drug interactions, and contraindications to alert physicians of current enrollment in an investigational drug trial were all built into the order. Additionally, an investigational barcode was made for barcode administration and investigational drug fact sheets were linked to patient medication administration records to assist with nursing administration. Investigational drug software was also utilized to provide additional informative labels, monitor drug inventories for expiration and low quantities, ensure enrollment into correct treatment arm, and document dispensing electronically for potential FDA audits. Furthermore, off hour protocol specific guidelines were developed for information sharing. Current clinical and medication safety practices as well as potential barriers were acknowledged in the development of protocol specific off hour guidelines. Once the guidelines were finalized, in-service presentations and training sessions were conducted for staff. Feedback was collected after implementation and guidelines were adjusted accordingly.

Results: Approximately one quarter of investigational drug trials have utilized this process. Nursing, pharmacy, and hospital staff have readily accepted and adapted their practices toward protocol guidelines since implementation. For example, in an intravenous acetaminophen surgical study, lack of both a contraindication alert as well as a distinguishable EMR file potentially allowed physicians to unknowingly order duplicate acetaminophen products beyond the four gram limit in twenty-four hours. IDS decided to implement the process due to a near

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miss involving this potential overdose as reported in the Safety Event Reporting System (SERS). Since implementation, no duplicate medication orders of acetaminophen, or near misses, have been reported in SERS. The contraindication alert as well as the distinguishable investigational EMR order, drug-drug interaction alerts, and built in maximum dosage limits have prevented prescribers from ordering acetaminophen products during the period that the study drug is being administered, thus, preventing overdose of acetaminophen. Additionally, off hour procedures have been well received by nursing and pharmacy staff, assisting with investigational medication administration and off hour enrollment of patients in adherence with the intravenous acetaminophen investigational protocol. This process has also been implemented in intensive care units, neurology, and cardiology investigational drug studies yielding similar results.

Conclusion: With the increasing volume and complexity of investigational drug trials, proper investigational drug management is of high importance. Continual collaboration with various health disciplines is greatly needed to improve workflow processes aiding with medication safety techniques associated with investigational drug trials. Additionally, the use of off hours guidelines and investigational drug EMR orders and alerts have proven beneficial and can be continually implemented in future investigational drug trials to ensure medication safety for patients involved in investigational drug research.

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Category: Leadership

Title: Setting a pharmaceutical care program in a health care group that manages different levels of geriatric services

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Purpose: Mutuam is a complex Health System Group that gives health care at different levels: long term (258 beds), nursing homes (779 beds), 8 teams giving support to 160 nursing homes, home (6 teams) and primary. The Pharmacy Department is composed by 7 pharmacists and 4 technicians; it gives different services to all the levels described before. As Pharmaceutical Care (PC), in geriatric services is not as well developed as in acute care, our purpose was to design and implement a coordinated Guideline for PC, considering the differences between the institutions that we attend.

Methods: In successive meetings between all the pharmacists we established all the activities of PC that we were performing and those that we would like to implement. We discussed the affinities and differences in the performance of these activities depending on the care level (primary care, long term care or nursing home). We developed a Guideline with all the activities including: Interventions, medication reconciliation, drug information, drug errors, side effects reporting and any communication about medication problems. A record to register and document all the activities was also implemented. PC activities information was given to the other members of the health care team (nurses, physicians, physiotherapists, etc.) in order to increase our cooperation and improve patient care. We show the results obtained between September (when we stated this new approach) and December 2013.

Results: The level and type of PC activities performed were different depending on the institution needs, prioritization of activities, and other professionals cooperation. Prior to September 2013, we had only registered data of medication errors in long term care. In the PC Guideline pharmacist becomes responsible and coordinators of the medication errors and adverse effects registration. This led to an improvement in the errors reporting; between September-December reporting, increased a 52% compared with the period January- August of the same year, especially prescription errors. As for the other PC activities; In long term care institutions we made: 77 interventions, 209 detections of problems related to medication, 154 medication reconciliation at the admission, 560 medication reconciliation at discharge, we gave information to 22 problems/questions raised by our health professionals. At the nursing homes 424 interventions were made (81% of acceptance); being the main problems detected inappropriate

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drug and no indication for drug. In primary care, the main problem was the quality of prescription, different guidelines and activities were performed to help physicians.

Conclusion: We have established a PC program and we have recorded the results of the different PC activities done by pharmacists. Even though, the differences in the levels of care, working using a unique approach from the Pharmacy Service, have led us to obtain more and better results of PC in less time. The coordinated work gives more coherence to the PC and also gives homogeneous results, despite the differences that we could have between our different health services. From this experience, we continue working to improve the level of PC given to our patients.

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6-119

Category: Leadership

Title: Implementation of ASHP Pharmacy Practice Model Initiative (PPMI) changes

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Purpose: The PPMI aims to provide the highest level of care to patients through a model that effectively uses pharmacists as direct patient care providers. The PPMI addresses many domains including: care team integration, leveraging pharmacy technicians, pharmacist credentialing and training, technology and leadership in medication use.

Methods: The pharmacy management team completed the PPMI Hospital Self-Assessment which identified several areas that needed improvement including: pharmacists being recognized as leaders in drug therapy management by other departments, prioritizing drug therapy management services to patients based on medication complexity and four of twenty action items relating to expanding properly trained technician roles. The management team created several high level goals for changes to better serve our patients and support our colleagues and brought these ideas to a committee of clinical/staff pharmacists for operational input. The final collaborative plan included several changes to our practice. The first change was to reassign duties of the inpatient anticoagulation shift. This shift had previously been responsible for 40 hours per week of anticoagulation dosing consults and teachings hospital wide as well as central pharmacy distributive functions. Second, decrease one operating room and five central pharmacy shifts from ten hours to eight hours which had provided 70 hours per week of coverage. Finally, the management team agreed to move forward with tech-check-tech implementation.

Results: The anticoagulation shift of 40 hours per week was reassigned to a new decentralized pharmacist (DCP) shift on the surgical unit. With this addition, all of the DCPs patient loads were decreased, allowing the dispersion of the anticoagulation consults to each respective DCP. Over the course of three rotations, 20 Advanced Pharmacy Practice Experience (APPE) students were trained to provide warfarin counseling and medication reconciliation. The Emergency Room (ER) pharmacy position was created from hours gained from converting several ten hour shifts into eight hour shifts. The ER DCP is available 70 hours per week in the evening from 4:30 pm to 2:30 am for admission medication histories/reconciliation, drug information questions and high risk medication counseling. With the collective changes, the medication reconciliations performed by a pharmacist have increased by 76.7% per week. Finally, the first stage of tech-check-tech has been implemented with the packaging of medications. This improvement has freed up 65 hours per month of pharmacist time.

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Conclusion: The PPMI assessment and subsequent actions proved to be a useful tool for our institution resulting in more direct patient care and interdisciplinary involvement. The pharmacy department was able to use the PPMI Action Plan as a springboard to rethink our current practice model. Changes that were made as a result of the PPMI assessment included adding surgical and ER DCP shifts without the addition of any full-time employees. Properly trained APPE students and pharmacy technicians aided in this transition by taking on additional roles and responsibilities that were previously all completed by a pharmacist.

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Professional Poster Abstract

6-120

Category: Administrative practice / Financial Management / Human Resources

Title: Implementing patient centered pharmacist care in emergency, intensive care & general medical units of a community hospital

Primary Author: Steven Dzierba; Email: steven.dzierba@pfizer.com

Purpose: This case describes our clinical pharmacy services implementation project. Pharmacy leaders will gain practical understanding of concepts & tools supporting expanding patient access to pharmacist services. We describe our journey from a centralized clinical service to a unit based pharmacy service model.

Methods: We focused on pharmacist services in our critical care, antimicrobial stewardship & general medical teams. We outlined processes for advocating support from medical, nursing, administrative & pharmacy staff. We described our approach to marketing, developing, recruiting, training, initiating & monitoring clinical pharmacy services. Methods for setting priority of services were identified. Recruitment, selection & training of our pharmacist teams were described. Metrics were outlined for enhancing momentum for expanded pharmacist care to our inpatients. We implemented pharmacist skills in gaining patient ownership of drug therapy regimens. Roles of our pharmacy team members were outlined. Formal & informal incentive training in creating change agents was initiated. Pharmacy staff meetings were routinely used for casting vision of future services & roles.

Results: Our pharmacy leadership & pilot project pharmacists played key roles in our service development & implementation. We created decentralized pharmacist roles on an Antimicrobial Stewardship team, Surgical Intensive Care, Medical Intensive Care, Emergency Department & two general medical units in less than one year. Metrics for continuing support of pharmacist services included documentation of monthly pharmacist interventions. Documented interventions were broken down by nursing unit, intervention types, physicians involved, medication categories, documenting pharmacist & financial impacts. Pharmacist to manage & monitor activities were presented monthly to Pharmacy & Therapeutics, Antimicrobial Stewardship, Medication Safety, Infection Control & Quality Committees. We have utilized drug therapy costs per adjusted patient day, readmission rates, length of stay & HCAHP score improvements as metrics to measure effectiveness of pharmacist services. We successfully developed & implemented a pharmacist service model to control drug therapy costs while enhancing patient care provision.

Conclusion: Delivering pharmacist services directly to patient care areas has reduced readmission rates & length of stay while enhancing care satisfaction & drug therapy cost control.

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Professional Poster Abstract

6-121

Category: Leadership

Title: A workshop on abstract development and poster presentation within pharmacy elective courses resulted in successful preparation for professional presentations at national meetings

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Purpose: Pharmacy accreditation standards promote student leadership skills, teamwork and the preparedness for practice within pharmacy curricula especially prior to advanced pharmacy practice experience (APPE) rotations. To support this goal, a faculty team designed a student group project requirement within several elective courses taken during the third Professional Year (PY3), with the goal of preparing students with the necessary skills for abstract and poster design, development, and presentation at professional meetings. This project examined the impact of incorporating student group projects prior to beginning APPE rotations at completion of the fourth Professional Year (PY4).

Methods: In the Spring 2013 semester, five pharmacy elective courses offered during PY3 of the PharmD Program to 116 students at a health care University included a workshop conducted by faculty and a media production specialist focused on poster design and presentation skills for presentation of group projects. After the workshop, student project teams were formed to develop a professional poster presentation. Results of previous research presented by this group supported the benefits of collaborative teamwork and professional presentation development prior to APPE rotations. Prior to taking their pharmacy elective course, only 20% of students had previously prepared a poster at the University and only 12% had presented a poster at a professional meeting. Upon completion of their APPE rotations, prior to graduation, the same group was invited to complete a survey to determine if their work resulted in the successful abstract submission and presentation of a poster in the Fall 2013 semester during PY4 at the 2013 ASHP Midyear Clinical Meeting (MCM). The survey was approved by the University's Institutional Review Board.

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Results: Of the 116 students who participated in the electives during PY3, 82 (71%) completed the survey at the end of PY4. Seventy-six percent were female and 24% were male. Eighty-five percent were between the ages of 22 and 25. Following graduation, 20% indicated that they will be completing a residency or fellowship while 12% plan to work in a hospital and 68% in a community pharmacy. Fifty-four percent were encouraged to participate in a pharmacy conference with the majority of students encouraged by a faculty member, preceptor or professional co-worker. Fifty-five percent of the responders reported co-authoring an abstract for a poster for a professional meeting, with 91% presented at the 2013 ASHP MCM and 9% presented elsewhere. Using a scale of 1 to 5 with 5 being the most prepared, students reported (mean +/- sd) of 4.0 0.9 for writing the abstract, 4.4 0.8 for designing the poster, and 4.4 0.8 for presenting the poster.

Conclusion: The formal guidelines and workshops provided during the five elective courses were effective in designing educational opportunities that fostered student leadership, promoted collaborative team-work, and professional poster skills. Post-PY4 findings indicated that the majority of students who participated in these electives felt well prepared and had successfully presented their work at the 2013 ASHP MCM. This confirmed the workshops within these electives prepared students for this endeavor. Our findings support benefits for collaborative team-work and professional presentation development prior to APPE rotations.

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Professional Poster Abstract

6-122

Category: Leadership

Title: Outreach program for members of an ASHP affiliate chapter

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Purpose: Key to the success of any professional organization is its membership. An outreach program called the Champion Program was created to better connect with members around the state and to offer additional member benefits. Member needs assessment lists continuing education as a primary reason why members join. With decreasing resources for live local meetings, alternative methods for the delivery of continuing education needed to be established.

Methods: The state affiliates Marketing Affairs Division created the Champion Program to meet the needs of its current members. Previous need assessments had identified that members still wanted continuing education but in formats that made it easier for them to access, such as during the day or via home study. The Champion Program was designed to bring services directly to the members work place with a goal to identify a Champion at each Illinois hospital with an organization member. Marketing Affairs Division members contacted affiliate chapter members at each member facility to request that they serve as a Champion. Champions were asked to post information provided to them concerning state affiliate activities and news, as well as coordinate live webinars organized through the state affiliate. Champions are sent an e-newsletter each month with affiliate chapter updates for them to either post or read during departmental meetings. Webinars are offered every other month on two separate dates for live continuing education and are also recorded for home study. Both members and non-members may take part in the webinars with CE credits provided free to members and a small fee for non-members. Only members may take advantage of the home study.

Results: By the end of the first year of the Champion Program, 48.4% of hospitals in the state with at least one affiliate chapter member had an assigned Champion. This number has stayed relatively the same with 52.9% of member hospitals having a Champion by the end of 2013. Six webinar topics are provided each year with twelve live presentation dates which are then available as home study for two years. In 2013, 53.1% of member hospitals participated in at least one webinar presentation. On average, there are 6.25 hospitals participating in each webinar presentation. Five members took advantage of the home study format in 2013.

Conclusion: Members in areas of the state where no live continuing education programming is available through the chapter now have an opportunity to receive free continuing education. Though modest success has been seen with the program, there is still opportunity for greater volunteer involvement as well as continuing education participation. A Champion Program Task Force has been created to identify ways to improve the program. Potential actions include:

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creating a focused member needs assessment about the Champion Program; conducting a Champion focus group to identify perceived benefits or roadblocks; and establishing specific metrics to measure the successes or opportunities for the program.

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Professional Poster Abstract

6-123

Category: Nutrition Support

Title: Comparison of two types of total parenteral nutrition (TPN) prescription methods in infants and children

Primary Author: Panos Papandreou; Email: papandreou.panos@gmail.com

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Purpose: Total parenteral nutrition (TPN) is currently commonly used in intensive care units for nutritional support of neonates and children. Adequacy and safety of TPN support are among the major concerns associated with these types of therapy. Avoiding prescription errors in individualized prescription orders is essential. TPN prescription in Greek hospitals is not based on standardized protocols, thus resulting in a wide variety formulations used. The aim of this study was to compare a specialized software program, which utilizes standardized protocols and procedures for assessing patients nutritional needs, versus individually prescribed regimens formulated by neonatologists and pediatricians.

Methods: A sample size of 59 pediatric patients, composed of infants (n = 28) and children (n = 31) aged from 1 to 15 years, were recruited for the study. They each received TPN support in intensive care unit with the use of regimens individually prescribed by doctors, for 9 days in average. The prescribed regimens were compared to a specialized software program based on guidelines and used by specialized pharmacists. The procedure involves input of patient specific data (i.e. age, weight, sex), underlying diseases and clinical condition, as well as subject specific treatment details. The software then analyzes the input data; determines nutritional parameters by implementing evidence-based statistical models and subsequently calculates an individual patients daily nutritional needs in total energy, protein, carbohydrates, fat, vitamins and minerals. Furthermore, this specialized software calculates the concentrations of each nutrient and total parenteral nutrition volume that will be administered on a twenty-four hour basis. Computer calculated TPN regimens of the patients were then compared with the regimens that were administered by pediatricians or neonatologists without the use of the computer program. The days of TPN support, as well as the total number of days of hospitalization, were recorded.

Results: At the end of the study, standardized protocols provided in total more energy ($P < 0.000$), protein ($P = 0.002$), glucose ($P = 0.015$) and fatty acids ($P < 0.000$), in grams per day and in grams per kilogram per day, compared to the non-standardized approach. All the micronutrients (minerals, sodium, potassium, magnesium, calcium, phosphorus) were greater in the computer calculated PN regimens, and shown to be statistically significant. The ratio calcium per phosphorus and non-protein kilocalories per grams of nitrogen were greater in that group ($P < 0.000$). Statistical tests were also performed at the first three days of PN, with a view to

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highlight the early trends. The electronic protocols provided statistically significant ($P < 0.05$) greater amount of fatty acids, calcium, potassium, magnesium and phosphorus while a tendency for a greater total energy intake was illustrated. With regards to the days of PN administration, both groups were fully assimilated.

Conclusion: Implementation of this specialized software program resulted in more adequate provision of energy and nutrients. The use of standardized protocols incorporating underlying diseases, procedural inputs and patient specific treatment details has shown to be beneficial to the patients, providing a better individualized PN regimen. The program, not only enables health professionals to overcome the burden of manual calculation, thus allowing the provision of individualized PN to become an efficient standard routine procedure, but also the quality of nutritional services would certainly benefit from its routine clinical application.

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Category: Nutrition Support

Title: Evaluation of nutrition support for esophageal cancer patients

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Purpose: Malnutrition is common in patients with esophageal cancer, severe weight loss is seen in many cases after surgery particularly. Appropriate nutrition support is required after esophagectomy. But in these patients, parenteral nutrition (PN) support is mostly carrying out without request of nutrition support team (NST) or pharmacist. The purpose of this study is to identify that there are no potential problems in patients with esophageal cancer who underwent esophagectomy.

Methods: This study is intended for esophageal cancer patients who entered intensive care unit of thoracic surgery after esophagectomy in cancer center at Samsung Medical Center from 2010 to 2012. It is a retrospective observational study and the information was collected through review of electronic medical records. We have analyzed route of nutrition support, calorie supply, duration of hospital stay, and weight change.

Results: A total 351 patients were enrolled. 225 patients received the PN from the next day after operation, the remaining patients received the PN from the day of surgery. The patients who received the PN with enteral nutrition (EN) were 99 patients (28.2%). The calorie of 31.9 kcal/kg/day average was supplied for a week following the operation. The patients who provided over 35 kcal/kg/day were 104 patients (29.6%). The patients who provided PN more than 10 days were 86 patients (24.5%) and duration of hospital stay was median 16 days (11~85 days). The patients with weight loss more than 5% at discharge were 105 patients (29.9%). The patient with PN provided after request of NST were only 23 patients (6.6%).

Conclusion: We have actively doing calorie support after esophagectomy through PN but weight loss is frequent. The patients who provided over 35 kcal/kg/day calorie were about 30%, approximately 25% patient received PN more than 10 days. It is expected that the patients who receiving calories more than demand for long term have a risk of expression of complication. We need further studies for appropriate calorie intake and complication associated with nutritional support in esophageal cancer patients.

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6-125

Category: Nutrition Support

Title: Evaluation of total parenteral nutrition(TPN) usage in elderly patients

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Purpose: Korea veterans hospital has typically high percentage of elderly patients with a few pediatric patients, so it uses only the premixed total parenteral nutrition(TPN) formula. In order to evaluate the appropriateness of TPN prescription, we analyzed the using TPN formulas, clinical specialty, the average fasting day and prescribed number of day by comparison of the european society for clinical nutrition and metabolism(ESPEN) and the american society for parenteral and enteral nutrition(ASPEN) TPN guidelines.

Methods: We conducted the research on the TPN prescription from January to December, 2013 retrospectively. Analysis of gender and age of the TPN patients was done and the usage of the premixed TPN formulas were studied to know the clinical specialty, the average prescription day and fasting day, Also we studied the nutritional status when the patients were prescribed TPN; the albumin level, percentage of ideal body weight, T lymphocyte count.

Results: Out of 3,940 TPN patients, male is 85.61 percent and 90 percent patients is over 60 years old. Neurosurgery, oncology and surgery are the main departments of TPN prescription. In case of using the central TPN, respiratory medicine and nephrology are the main departments. The average fasting day of peripheral line TPN is 4.17 days and central line is 7.02 days. It is almost 20 percent that the peripheral line TPN prescribing days were over 17 days. And the case of TPN prescription with no nutritional assessment was 8.86 percent. The use of TPN with central line is recommended when the long-term administration of 2 weeks or more are expected in general, but it was confirmed that it many cases it is not. Further, it was higher than 50percent and may be between 1 and 2 days after admission, the short term use. Out of 91.16 percent nutritional assessment group, 22.65 percent was the low-risk group, 10.34 percent was moderate-risk group, 1.35 percent was high-risk group. Consequentially, nutritional status of 56.80 percent was good.

Conclusion: Compared to ASPEN and ESPEN guidelines, we found that the TPN was prescribed with insufficient nutritional assessment and the term of peripheral line TPN was longer than expected. To conduct more accurate nutritional support, our study is indicated that the nutritional assessment of TPN patient is essential and the improvement of understanding and

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awareness overall of TPN are required. In addition, we suggest the need for education of medical staff and establishment of TPN prescription guidelines.

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Category: Operating Room Pharmacy

Title: Influence on blood use in orthopedic surgery with a blood management program including tranexamic acid

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Purpose: Strong evidence exists that tranexamic acid reduces blood loss in many types of surgery. A Cochran analysis of 129 trials from 1972 to 2011 with 10,488 surgery patients found that blood transfusions were decreased by one third with tranexamic acid use. A community hospital sought to determine if use of tranexamic acid, in conjunction with an institutional blood management program, had an impact on blood use in non-arthroscopic orthopedic surgeries of hips and knees.

Methods: In January 2012 an independent blood management consultant group educated orthopedic surgeons on restrictive blood management. In this strategy one unit of packed red blood cells, rather than two units, is administered for hemoglobin less than 7 grams per deciliter. In April 2012, one orthopedic surgeon adopted the practice of administering two grams of intravenous tranexamic acid per surgery case. One gram of the medication was given immediately before surgery, and an additional gram was given at the close of surgery. By April of 2013, all orthopedic surgeons in the institution had adopted use of tranexamic acid, and most patients were receiving a standard two gram total dose. Retrospective data was collected on all adult non-arthroscopic orthopedic surgical inpatients treated at the medical center. For months of January 2012 to January 2014, units of packed red blood cells administered per discharged case was determined. Number of grams of tranexamic acid administered per discharged case was collected for months of April 2012 to January 2014.

Results: From January 2012 to January 2014, an average of 127 patients per month were included in the study group. Over this time frame blood administration decreased from 0.71 to 0 units of packed red blood cells administered per discharged orthopedic surgery case. A mean of 0.23 units per discharged orthopedic case was administered over the 25 months. With the adoption of tranexamic acid, medication use increased from 0.12 grams in April 2012 to 2 grams in January 2014 per discharged case. Over these months an average of 1.71 grams per case was administered.

Conclusion: Blood utilization was decreased in a community hospital with a restrictive blood management strategy and adoption of the use of tranexamic acid in non-arthroscopic orthopedic surgeries.

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Professional Poster Abstract

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Category: Pain Management

Title: Clinical and economic monograph and budget impact analysis of intravenous acetaminophen in post-operative orthopedic patients

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Purpose: Effective pain treatment is essential for good clinical outcomes, decreasing healthcare costs and preventing undue burden to the hospital system. Intravenous acetaminophen is approved for moderate to severe pain with adjunctive opioid analgesics. Currently, however, there is resistance to its use and many do not feel there is an adequate benefit to its utilization due to its high acquisition cost and the availability of cheaper, efficacious pain management drugs. This project aims to evaluate the clinical efficacy and safety of intravenous acetaminophen on orthopedic post-operative pain, as well as its economic impact with a corresponding budget impact analysis.

Methods: Clinical: From March to April 2014, Medline and Pubmed were searched using the following search terms: Ofirmev, IV Acetaminophen and orthopedic, and IV Acetaminophen orthopedic. Of the 22 articles, four were chosen for efficacy and safety review. Articles limited to post-orthopedic surgery were included. Studies using intravenous propacetamol exclusively were excluded due to its differing side effect profile. Economic: From March to April 2014, Pubmed was searched using the following search terms: IV acetaminophen and econ, opioid orthopedic and econ, and IV acetaminophen and cost. Of the 48 articles, three studies were included for economic review, though none are direct pharmacoeconomic analyses. Outcomes analyzed were decrease in opioid consumption and reductions in adverse drug events. Exclusion and inclusion study criteria are the same. Budget Impact Analysis: A model from the budget perspective of a moderately sized community medical center with a one-year time horizon was constructed to evaluate the potential benefits of IV APAP using the data discovered in the economic review. The model generated a random sample of 550 individuals and estimated their 24-hour opioid and adverse drug related costs. Three scenarios (one post-surgical dose, four post-surgical doses, and the base case) were considered and their costs compared.

Results: All the clinical studies conclude intravenous acetaminophen is safe and effective in orthopedic post-operative pain. There were significant reductions in opioid consumption, increased patient satisfaction, lowered pain scores, and increased time to rescue medication with very few not clinically significant adverse drug events. The economic findings were more

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inconclusive. Only some of the included studies found significant decreases in opioid consumption translating to a possible direct savings of \$4.81 to \$5.32 per patient. Even fewer studies observed significant reductions in adverse drug events, the other noteworthy component of cost savings identified in our research. Giving even a single dose of IV APAP post-surgically generates an incremental cost of approximately \$5,900 dollars, and administering it as indicated by the manufacturer (four times daily) costs over \$24,500. Sensitivity analyses were conducted and concluded the primary driving force of this increased cost was the price of IV APAP; if half the price were charged, incremental costs would shrink to approximately \$2,500 and \$10,800 dollars, respectively.

Conclusion: Implementing intravenous acetaminophen for orthopedic post-operative pain has a significant budget impact. Even when taken to the extreme ends of current values, the economic benefits do not outweigh the heavy costs that come with employing the expensive new agent. The question then becomes whether the clinical benefit for intravenous acetaminophen is worth the heavy incremental cost. Unfortunately, although intravenous acetaminophen has been shown to be both safe and effective and represents significant steps forward over current opioid-only methods of pain control, the modest benefits do not present enough of an improvement to justify the heavily increased costs to an institution.

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Category: Pain Management

Title: Assessment of opioids use for cancer pain in Lebanese hospitals

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Purpose: Pain is one of the most common associated symptoms in cancer patients. It requires potent analgesic agents to decrease morbidity, and improve quality of life. Opioids are well recognized potent pain killers that are being frequently utilized in clinical oncology departments. The NCCN guidelines recommend an optimal pain management plan involving the opioid agent selection and its dosing. The purpose of this study was to assess different opioids being used for pain management in Lebanese cancer patients.

Methods: This prospective multicenter observational study was approved by the institutional review board. Men and women aged 18 years and above were observed if they have had any type of cancer pain, and were receiving opioid analgesia. Patients with brain metastasis, bone fractures, organ obstruction and perforation, or surgery as part of the treatment were excluded. 700 patients were screened over a period of 2 year, where 300 patients have met the eligibility criteria and were observed. The primary outcome measure was assessment of adherence to the NCCN guidelines in terms of opioid agent selection. Secondary outcome included assessment of adherence of opioid dosing plan. Data are expressed as frequencies, and evaluation of primary and secondary outcomes utilized analysis of chi-square.

Results: Most patients were not adhered to opioid selection guidelines (86 percent versus 14 percent, P equals 0.001), where most of the non-adhered patients (80 percent) were on meperidine, and the remaining 6 percent were maintained on short acting morphine. For the opioid dosing plan, non-adherence was observed in 70 percent of patients; versus 30 percent were adhered (P equals 0.002). The non-adherence in opioids dosing plan was attributed to non-routine pain re-assessment after initial management plan, where only 15 percent of patients were re-assessed after 24 hours following initial pain management, versus 85 percent (P equals 0.001).

Conclusion: Poor overall adherence to NCCN guidelines was found. The gaps were related to extensive use of meperidine and short acting morphine, as well as lack of pain re-assessment following initial management. Hence, clinical pharmacists should continue working on increasing the level of awareness among other healthcare team members to insure an optimal pain management plan in cancer patients.

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Category: Pain Management

Title: Impact of the perioperative use of intravenous acetaminophen in patients undergoing intraabdominal and breast reconstruction surgery

Primary Author: Kimberly Tallian; Email: kim.tallian@gmail.com

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Purpose: The multimodal approach for managing acute pain, which consists of two or more analgesics with different mechanisms of action, is well accepted. This study compared the traditional management of perioperative pain in patients undergoing intraabdominal and breast reconstruction surgery with patients receiving concomitant intravenous acetaminophen (IV APAP). We evaluated the ability of IV APAP to reduce opiate burden, length of stay, and pharmacoeconomic outcome.

Methods: This retrospective study of 120 patients, who received traditional pain management (N = 60) or concomitant IV APAP (N = 60) was conducted between January 2012 and December 2013. Patient demographics, clinical data, pain scores, drug therapy, length of stay, and cost data were documented for each patient. Descriptive statistics were used for baseline demographics as well as continuous and nominal data.

Results: Baseline demographics were similar between those receiving and not receiving IV APAP. Patients who received concomitant IV APAP used 106.9 mg of IV morphine equivalents compared to 127.2 mg in the traditional pain management group (p=0.24). Daily mean pain scores and patient-controlled analgesia use did not differ significantly between the two groups (p>0.05). The length of stay in the concomitant IV APAP group was 127.1 hours versus 96.1 hours in the traditional group (p<0.05). The total average cost of stay per patient in the concomitant IV APAP group was \$15,667 and \$11,699 in the traditional group (p=0.03).

Conclusion: IV APAP may not be cost effective adjunctive therapy in comparison to traditional pain management in patients undergoing intraabdominal and breast reconstruction surgery. Our study demonstrated similar opiate use, increased length of stay, similar daily mean pain scores, and increased costs.

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Professional Poster Abstract

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Category: Pediatrics

Title: Comparing national data with frequency and severity of parenteral nutrition medication errors at a large childrens hospital after implementation of electronic ordering and compounding

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Purpose: Parenteral Nutrition (PN) is a complex solution , classified by the Institute of Safe Medicine Practices (ISMP) as a high alert medication. National guidelines have been established to try and minimize patient errors, and literature shows poor compliance with these guidelines. This study is a comparison of the national guidelines, safe practices and consensus guidelines from the American Society of Parenteral and Enteral Nutrition and American Society of Health-System Pharmacists to the parenteral nutrition practice of a 300 bed pediatric hospital (Primary Childrens Hospital, PCH) to determine if compliance to these standards decreases errors in prescribing, transcription, preparation and administering PN and provides sustainable cost savings.

Methods: PN data was retrospectively collected from 2004 through 2013. Seven years of data was reviewed for number of PN solutions compounded and events reported. Events evaluated compounding errors and compatibility reports that were compared to previously published data. Comparisons were made against : Safe Practices for Parenteral Nutrition, A.S.P.E.N Parenteral Nutrition Safety Consensus Recommendations, Frequency and Severity of Harm of Medication Errors Related to Parenteral Nutrition Process in a Large University Teaching Hospital (Safety Surrounding Parenteral Nutrition Systems), Compliance with Safe Practices for Preparing Parenteral Nutrition Formulations, and A Parenteral Nutrition Use Survey with Gap Analysis.

Results: Seven years of data included 84503 PN solutions. Evaluation of this data revealed full compliance in the areas that The Safe Practices and Safety Consensus Recommendations suggested as mandatory, strongly recommended and recommendations worthy of consideration. Two hundred and thirty errors were categorized as prescribing, transcription, preparation and administration, and NCC MERP harm scores were assigned. As published in the literature from a Large University Teaching Hospital categorized errors as prescribing, transcription, preparation and administration and determine the NCC MERP harm scores for events. A 1.6% error rate (74 errors in 4730 PN) was compared to a 0.3% error rate at PCH (230 errors in 84,503 PN solutions). The published data reported 2% of the errors were in the prescription process and 3% at PCH. Transcription had 39% of the errors compared to zero at PCH . Preparation had 24% of

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the errors with PCH having a 2% rate. Administration processes accounted for 39% of errors in the literature compared to 95% at PCH. Errors were assigned A-D harm scores 92% of the time nationally, similar to the 91% from PCH. Harm Scores E-F the literature reported 8% and PCH reported 9%. Overall PCH had 2.6 errors/1000 PN compounded compared to 15.6 errors/ 1000 nationally. PCH data showed full compliance to 11 audited recommendations outlined by Compliance with Safe Practices for Preparing Parenteral Nutrition Formulations. Nation gap data as identified in the Parenteral Nutrition Use Gap Survey indicated the national compliance gap analysis was 46.7% complaint, ranging from 90% to 7% compared with 100% compliance for PCH. Implementation of the CPOE process resulted in a cost reduction of \$137,629 yearly (\$963,403 total study), a process sustainable over the seven year study.

Conclusion: Implementation of and adherence to national guidelines in conjunction with computerized physician order entry, electronic transcribing and effective use of an automated compounding device, eliminating paper orders, increases safety and decreases errors. Utilization of such processes lead to sustainable decreases in errors and cost and improvement in safety,

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Category: Pediatrics

Title: Implementation and outcomes of a neonatal abstinence syndrome (NAS) treatment guideline

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Purpose: Neonatal abstinence syndrome (NAS) is a syndrome of drug withdrawal with non specific signs and symptoms that occurs in infants following in utero exposure to drugs. As legal and illegal drug use by women of childbearing age increases, so has the incidence of NAS. NAS severity can be subjectively scored using the Finnegan tool. Currently, there is no drug of choice or evidence based guideline for treatment. The purpose of this project was to standardize and implement a multidisciplinary treatment guideline for NAS. Secondary objectives evaluated included duration of treatment and length of hospital stay.

Methods: A multidisciplinary committee was formed to evaluate the care and treatment of NAS infants. The committee decided to change the drug of choice from methadone to morphine. This decision was based on the potential for faster weaning attributed to the shorter half life of morphine. After nationwide benchmarking, an NAS treatment guideline utilizing morphine was created with committee oversight. The committee developed recommendations against discharging infants home on morphine due to potential safety concerns, the complexity of weaning, and outpatient pediatricians that might be unfamiliar with NAS treatment. Prior to implementation, education was presented in the form of a poster and discussed with staff. A scoring tip sheet was created to assist with subjective scoring and the NAS policy was updated. A retrospective chart review was conducted to determine baseline data. Data included: duration of treatment, and length of hospital stay. Infants treated with methadone for NAS between the dates of May 2011 to September 2012 were included in the analysis. The new NAS treatment guideline utilizing morphine was implemented in October 2012. Prospective analysis included infants treated with morphine for NAS from the dates of October 2012 to May 2014.

Results: Twenty-one infants were treated for NAS with methadone during May 2011 to September 2012. Twenty-six infants were treated for NAS with morphine per our NAS treatment guidelines from October 2012 to May 2014. The average duration of treatment was 18 and 21 days, average length of hospital stay was 21 and 23 days in infants respectively. However, 60% of methadone treated infants (n=13) were sent home on a taper while 0% were sent home on morphine.

Conclusion: NAS staff education and implementation of a standardized treatment guideline were critical for optimizing patient care. We did not see a dramatic increase in the number of infants treated for NAS, or in the average duration of treatment or length of hospital stay. One factor that greatly affected outcomes was the change in practice for discharging infants home on medication. Weaning infants off these medications in a monitored hospital setting improved patient safety and potentially improved patient outcomes.

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Professional Poster Abstract

6-133

Category: Pediatrics

Title: Low cost pharmacist-directed diabetes awareness and prevention program targeting elementary students

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Purpose: As national rates of Type II diabetes grow, efforts to reduce the rate of disease must be aimed at the youth of America. In 2004-2005, records show 20.4% of third graders in Hardin County, Ohio were considered overweight. The objective of this program is to provide a low cost interactive program aimed at educating third grade students on the basics of diabetes and strategies to prevent the disease through nutrition and physical activity. The project was designed to assess the students previous knowledge and their capability to attain and maintain knowledge through an interactive program.

Methods: This study was approved by IRB. This research initiative was modeled after an American Diabetes Association program. Two student pharmacists designed and implemented an interactive diabetes awareness program in association with a local elementary school. The program consisted of three different lessons all approved by the health teacher for incorporation into her curriculum as part of the students normal physical education classes. The first lesson plan was on diabetes followed by nutrition and physical activity. Each lesson was formatted to include elements of an educational video, teaching, and an interactive game. Each lesson was conducted during consecutive physical education classes. A pre and post-test, consisting of ten true or false questions, were used to assess the students understanding of material discussed during the program. The test was conducted using clicker devices that recorded students answers anonymously. The post-test results were compared to pre-test results to determine if there was an improvement in their knowledge base over time and if they retained this information over several weeks. Data were analyzed using SPSSx software for both descriptive and inferential statistics. Alpha was set at 0.05. The clicker system automatically calculated percentages when the students clicked on the answers.

Results: The results showed that third grade students do have some working knowledge about the topics discussed especially nutrition and physical activity. This demonstrates that the physical education curriculum is establishing a basic knowledge of nutrition and exercise between kindergarten and the 3rd grade. The pre-test to post-test comparison did show that students still had some knowledge base deficits. The pre-test average was 69.81% with a post-test score of 81.37% (p -value < 0.001). The two-tailed paired t-test showed statistical significance between the pre and post-tests. Nine of the ten questions increased in percentage from the pre to post-test. Only question ten, testing knowledge on the food groups, decreased

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slightly from a 35.14% to 32.91% on the post-test. The greatest percentage change was seen on question five regarding the use of glucose as energy, a 34.72% increase. The program completed by the American Diabetes Association with the College of Nursing at Iowa University cost \$4.024 per student. Where as our program utilized materials of the physical education program at the elementary school and cost \$0.13 per student.

Conclusion: The positive results of this program demonstrate the value of diabetes education and prevention strategies aimed at younger generations. Programs can be designed to be low cost yet still effective for the students. A program such as this could easily be replicated at elementary schools across the country. An updated program will be repeated in one year with the same students as fourth graders to provide more longitudinal learning opportunities. The hope is this program becomes a part of the schools curriculum and that pharmacists and student pharmacists can be active members of educating youth to help prevent diabetes.

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Professional Poster Abstract

6-134

Category: Pharmacokinetics

Title: Blood distribution of bortezomib and its kinetics in multiple myeloma patients

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Purpose: The proteasome inhibitor bortezomib is used for the treatment of multiple myeloma. Bortezomib showed superior efficacy against high-dose dexamethasone. For some patients, bortezomib has poor therapeutic effects or causes serious adverse effects. Pharmacokinetic data for bortezomib are needed in order to ensure its safe and effective use. However, the blood distribution of bortezomib has not yet been fully evaluated in multiple myeloma patients. Assessment of the blood disposition of bortezomib can contribute to the dose optimization for patients with multiple myeloma. The aim of this study was to evaluate the blood distribution of bortezomib and its kinetics in multiple myeloma patients.

Methods: The study was performed in accordance with the Declaration of Helsinki and its amendments, and the protocol was approved by the Ethics Committee of Hamamatsu University Hospital. The patients received information about the scientific aim of the study, and each patient provided written informed consent for participation in the study. Eighteen multiple myeloma patients receiving intravenous bortezomib at Hamamatsu University Hospital between January 2010 and November 2012 were enrolled. Bortezomib and dexamethasone sodium phosphate were administered intravenously on days 1, 4, 8 and 11 of each cycle (withdrawal on days 12–21). Blood specimens were drawn just before the bortezomib administration on days 1 and 8 in the second and third cycles and after discontinuation. The bortezomib concentrations in the whole blood and plasma were determined using LC-MS/MS. The relationships between the bortezomib concentration and blood components were evaluated.

Results: The whole blood concentration of bortezomib on day 8 was significantly higher than that on day 1 in the second cycle. No significant difference was observed in whole blood concentrations of bortezomib between day 8 in the second and third cycles. Interindividual variation was observed in whole blood concentrations of bortezomib on day 8 in the second (IQR, 32.8|59.2 µg/l) and third (IQR, 34.2|46.8 µg/l) cycles. The bortezomib concentration in blood and blood cells was 3- and 7- fold higher than that in plasma. Interindividual variation was observed in the blood cell concentration of bortezomib in multiple myeloma patients (IQR, 69.2|97.5 µg/l). The bortezomib concentration in whole blood was correlated with red blood cell

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count and hemoglobin level. In contrast, the bortezomib concentration in whole blood was not significantly correlated with white blood cell count, platelet count and serum albumin level. The median of the half-life of bortezomib in whole blood was 23 days.

Conclusion: Bortezomib was taken up into red blood cells to only a limited extent. The bortezomib concentration in whole blood was much higher than that in plasma and was correlated with the red blood cell count. Bortezomib was present in blood for 40 days or longer and was eliminated in parallel with the lifespan of red blood cells. The turnover of red blood cells can affect the pharmacokinetic disposition of bortezomib in multiple myeloma patients.

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Professional Poster Abstract

6-135

Category: Pharmacokinetics

Title: Pharmacokinetic interactions between canagliflozin and several medicines potentially co-administrated in patients with type 2 diabetes mellitus

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Purpose: Canagliflozin (CANA) is a sodium glucose co-transporter 2 inhibitor approved as an adjunct to diet and exercise to improve glycemic control in adults with type 2 diabetes mellitus (T2DM), with a recommended dose of 100 or 300 mg once daily (QD). This analysis reviews potential pharmacokinetic interactions between CANA and a number of drugs that may be administrated in combination, namely metformin, hydrochlorothiazide (HCTZ), glyburide, simvastatin, warfarin, rifampin or digoxin.

Methods: Phase I studies were conducted in healthy subjects to determine the effect of administration of metformin (300 mg CANA QD for 8 days, followed by single dose 2,000 mg metformin, N = 14), HCTZ (300 mg CANA QD with 25 mg HCTZ for 7 days, N=30), glyburide (200 mg CANA QD for 6 days, followed by single dose 1.25 mg glyburide, N = 29), simvastatin (300 mg CANA QD for 7 days, followed by single dose 40 mg simvastatin, N=22), warfarin, (300 mg CANA QD for 12 days, followed by single dose 30 mg warfarin, N =14), rifampin (single dose 300 mg CANA on Days 1 and 10, and rifampin 600 mg QD on Days 4 to 12), N=14) or digoxin (300 mg CANA QD for 7 days with 0.5 mg of digoxin on first day, followed by 0.25 mg QD for 6 days, N = 18) in combination with CANA.

Results: No clinically meaningful interaction was observed when 300 mg CANA was co-administered with metformin, HCTZ or warfarin. Co-administration of single dose glyburide after multiple doses of 200 mg CANA indicated no clinically significant effect on the pharmacokinetics of glyburide. Co-administration of multiple doses of CANA (300 mg) with simvastatin (40 mg) compared with simvastatin alone slightly increased the systemic exposures to simvastatin (mean AUC ratio= 1.12 [90% CI= 0.94; 1.33]; mean C_{max} ratio= 1.09 [90% CI = 0.91; 1.31]) and simvastatin acid (mean AUC ratio= 1.18 [90% CI= 1.03; 1.35]; mean C_{max} ratio= 1.26 [1.10; 1.45]), but did not change the active HMG-CoA reductase inhibitor levels. Co-administration of 600 mg rifampin with 300 mg CANA once daily decreased CANA AUC and C_{max} by 51% and 28%, respectively (mean AUC ratio= 0.49 [90% CI= 0.44; 0.54]; mean C_{max} ratio= 0.72 [90% CI= 0.61; 0.84]). Co-administration of digoxin (0.25 mg) with 300 mg CANA QD resulted in 20% and 36% higher digoxin AUC₀₋₂₄ and C_{max} values, respectively, compared with digoxin alone (mean AUC ratio= 1.20 [90%CI= 1.12; 1.28]; mean C_{max} ratio= 1.36 [90% CI=1.21; 1.53]).

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Conclusion: Use of metformin, HCTZ, glyburide, simvastatin or warfarin in combination with CANA did not result in clinically meaningful drug-drug interactions that would require dose adjustment. Rifampin use decreased the exposure to CANA, and therefore may decrease CANA efficacy. If an inducer of UDP-Glucuronosyl Transferases (UGTs) such as rifampin must be administered to patients treated with CANA 100 mg, increasing CANA dose to 300 mg should be considered when additional glycemic control is needed. An increase in the exposure of digoxin was observed with CANA co-administration. Patients being treated with CANA and taking digoxin should be monitored appropriately.

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Professional Poster Abstract

6-136

Category: Pharmacy Law / Regulatory / Accreditation

Title: Non medical prescribing reaccreditation - maintaining competency in an acute hospital trust

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Purpose: Currently there is no systematic and robust method to assess the competency of practising Non-Medical Prescribers (NMPs). All NMPs have the responsibility to remain up to date with their knowledge and skills that enable them to prescribe competently and safely within their field of expertise. The national competency framework for all prescribers contains three domains, each containing three dimensions. This framework underpins the NMPs personal responsibility for prescribing. The aim was to identify a set of appropriate assessment tools and modalities to provide sufficient evidence and to map them against the prescribing framework.

Methods: A multi-disciplinary steering group was assembled consisting of current trust nurse and pharmacist NMPs and the regional NMP lead. Through a literature search a number of assessment tools were identified. Evidence of multiple validation and use in structured education and training programmes was required. The identified tools were assessed for robustness, reliability, evidence base and comprehensiveness and certified by the steering group. This was mapped against the national competency framework by consensus decisions of the steering group. The mapping process identified which assessment tools were appropriate to assess each dimensions within the three domains. The mandatory scope of practice was also evaluated to see which standards and domains it could support in addition to the selected tools. All the identified tools were compiled in a multi-source assessment tool for future easy use by NMPs.

Results: More than 10 different validated assessment tools were identified through the literature and considered for robustness, reliability, evidence base and comprehensiveness. The steering group evaluated the tools based on multiple validated evaluation methodologies and use in structured education and training programs such as used by the Competency Development and Evaluation Group (CoDEG) and the United Kingdom Clinical Pharmacist Association (UKCPA). The 4 tools selected and considered for inclusion in the annual NMP competency portfolio were Mini Clinical Evaluation Exercise (Mini-CEX), Case Based Discussion (CBD), 3600 peer review, and a Prescribing Portfolio including a Continuous Professional Development (CPD) log, a prescribing log and the mandatory scope of practice. Exclusion of tools was mainly due to unacceptable time and staffing requirements such as lengthy observational methods or requirement of multiple staff. They proved to cover all competencies and in the majority of dimensions through multiple assessment tools. Two or more assessment tools could be mapped against each of the nine dimensions and the CPD log was found to be assessing all the

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dimensions. The tools identified and agreed by the steering group are compiled in a multi-source assessment tool portfolio and electronically accessible on the trust intranet.

Conclusion: The literature search provided a wide range of assessment tools. The mini-CEX and the peer review were unfamiliar tools particularly to the nursing staff which needs to be handled with sensitivity and support. Pharmacists are familiar with the tools, being used traditionally by foundation pharmacists and to support career progression. The developed generic multi-source assessment tool covers all 9 dimensions of the national framework and will also support professional requirements for regular proof of fitness to practice. The appropriateness of the assessment tool will need to be tested through pilot portfolios and suitability investigated before implementation.

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6-137

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Increased usage of a calcium-free balanced crystalloid for fluid resuscitation of critically ill patients: a budget impact analysis

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Purpose: Intravenous infusion of large volumes of isotonic crystalloids is common practice for the resuscitation of critically ill patients. Commonly used crystalloids include 0.9% saline, which contains only sodium and chloride, and balanced crystalloids, which contain physiological electrolyte concentrations. There is growing evidence that resuscitation with balanced crystalloids may be associated with more favorable clinical outcomes and reduced resource usage. A budget impact model (BIM) was constructed to assess the hospital-level economic impact of increasing usage of calcium-free balanced crystalloids versus 0.9% saline for fluid resuscitation of critically ill patients.

Methods: The BIM compared annual and cumulative cost savings associated with increased usage of calcium-free balanced crystalloids versus 0.9% saline for resuscitation of patients meeting systemic inflammatory response syndrome (SIRS) criteria over a 5-year period. The clinical inputs to the BIM were based on analysis of a large US electronic health record (EHR) database, which found outcome differences in complications between SIRS patients receiving 0.9% saline and calcium-free balanced fluid. User-defined model inputs included hospital characteristics, current and projected balanced crystalloid usage for SIRS patients, and balanced crystalloid adoption rate over 5 years. Attributable costs, per-liter fluid costs and per-episode complication-associated costs were obtained from published reports. An initial base case was defined as a 300-bed hospital with 80% occupancy, which projected to an estimated 504 SIRS patients per year based on the EHR used for the outcomes study. The base case included current balanced crystalloid usage of 5% and projected year 5 balanced crystalloid usage of 75%, with exponential year-over-year adoption. In order to assess the impact of adoption in different settings, additional analyses were carried out by varying hospital size and projected year 5 usage.

Results: Examination of the predefined base case revealed considerable annual and cumulative savings associated with increasing calcium-free balanced crystalloid usage. By year 1 (9% balanced crystalloid usage), annual savings (versus current usage) were estimated to be \$69,846. By year 5, (75% balanced crystalloid usage), annual estimated savings were \$1.36M, and cumulative 5-year savings were \$2.77M. These savings were driven by decreased complication rates that were evident despite increased fluid costs. The largest savings were attributed to

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hospital LOS, professional services, and diagnostic costs, with annual savings for these cost categories all exceeding \$290,000 by year 5. Scenario analyses revealed greater potential cumulative 5-year savings for larger hospitals or hospitals with higher projected balanced crystalloid usage. Cumulative 5-year savings were estimated to be \$4.67M for a 600-bed hospital with current and projected year 5 balanced crystalloid usages of 5% and 95%, respectively. In contrast, cumulative savings for a 100-bed hospital with current and projected year 5 balanced crystalloid usages of 5% and 25%, respectively, were estimated to be \$529,371.

Conclusion: This budget impact analysis suggests that increased usage of calcium-free balanced crystalloids for fluid resuscitation may represent an important opportunity for hospitals to minimize complications and increase efficiency associated with managing SIRS. While increased balanced crystalloid usage was associated with greater fluid costs, these were greatly outweighed by the savings resulting from decreased complication rates. Savings were evident across a range of scenarios, suggesting potential benefits to hospitals of various sizes and with different adoption capabilities.

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6-138

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Implementation of a standard administration time and batch preparation for daptomycin maintenance doses reduces waste

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Purpose: Daptomycin is an important antibiotic for the treatment of resistant Gram-positive bacteria. Daptomycin is dosed mg/kg according to body weight and is only available as 500mg vials, resulting in potential for waste. Based upon published experience, we implemented a LEAN process policy to batch prepare and administer maintenance doses at a standard time in March 2013. Our electronic medical record was enhanced in February 2014 to improve compliance with policy. The primary objective of this study was to evaluate the impact of this policy on institutional waste and expenditures.

Methods: This IRB approved study evaluated all inpatient daptomycin doses dispensed March 1-31, 2014. Data collection included the following information daily: number of first doses, number of maintenance doses, dose amount in mg, and number of vials utilized. The primary outcome was institutional waste and expenditure reduction. Waste and expenditure reduction were calculated by comparing the number of vials utilized with the batch method to the expected number of vials that would have been utilized without batch preparation.

Results: 197 total daptomycin doses were dispensed; median 6 doses per day (range 3 - 12 doses). Median total amount of daptomycin dispensed for first doses per day was 550 mg, and a range of 0-6 vials were utilized per day for first doses. Median total amount of maintenance doses dispensed was 2900 mg per day (range 1400-7200 mg). 273 vials were used with the batch method. 321 vials were expected if batch preparation was not implemented. In total, 48 fewer vials were utilized during the month. Waste was reduced by a median of 1 vial per day (range of 0-5 vials), amounting to a monthly savings of approximately \$16,000. Annualized, batch preparation is expected to prevent waste of 365-565 vials per year or approximately \$120,000-\$190,000.

Conclusion: Implementation of a LEAN process intervention for preparation and administration of daptomycin reduced waste and was cost effective for our institution.

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6-139

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Outcomes of adherence training among an interprofessional team of students caring for underserved patients

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Purpose: The purpose of this project is to enhance the ability of interprofessional (IP) students to assess and manage non-adherence in an underserved population through an interprofessional clinic. The University of Cincinnati's Open School, an interprofessional organization focused on quality improvement initiatives, is actively engaged in a self-management clinic. Faculty and student teams comprised of physicians, pharmacists, nurses, dietitians, social workers, physical therapists and dental hygienists have direct patient contact helping patients to self-manage their diet, activity level, medication adherence and overall health. Lack of skills specifically relating to the management of medication non-adherence was identified as a desired area of improvement

Methods: 1) Develop a live and online, educational module, with pre- and post- module assessment, defining adherence and including tools to assess and manage non-adherence. 2) Document the ability of IP students to apply these tools in a clinical setting by trained faculty. 3) Measure adherence of clients on a longitudinal basis via medication possession ratios (MPR), calculated from refill records of clients engaged in study, and the Morisky Medication Adherence Scale (MMAS).

Results: Of the 71 student and faculty participants, 77.6% showed a significant improvement ($p=0.04$) in knowledge of non-adherence and the tools used to assess adherence based on pre- and post- module assessments. Nineteen students who completed the learning module were assessed longitudinally by faculty on application of the adherence tools. All 19 students documented the ability to incorporate these adherence tools in the self-management clinic, with the second observation showing significant improvement over the first ($p=0.034$). Seventy of the participants also completed self assessments of confidence in nine areas related to the use of the adherence tools with mean responses ranging from 2.01-2.36 (Scale 3 = Very comfortable, 2 = Comfortable, 1 = Not at all comfortable). Adherence assessment of 33 clients through MMAS indicated a significant improvement between their baseline and follow-up visits ($p=0.028$). The medication possession ratios (MPR), calculated from refill records of clients engaged in study, showed improvement in 15 of the 33 clients

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Conclusion: The describe IP model of training demonstrated an improved ability of students from multiple disciplines to incorporate adherence tools into practice. Further, the incorporation of these skills resulted in improved adherence of this underserved patient population.

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6-140

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Adherence and medical costs among patients with epilepsy receiving AEDs classified as controlled substances: an analysis of a large administrative claims database

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Purpose: Several antiepileptic drugs (AED) used to treat seizures are classified as controlled substances by the US FDA. The objective of this analysis was to assess the potential impact of initiating treatment with a controlled AED on treatment adherence and medical costs among patients with epilepsy.

Methods: Study patients were identified from the 2006-2012 PharMetrics Plus Database. Continuously eligible (one year pre-index [baseline] and one year post-index [follow-up]) patients with ≥ 1 inpatient or ≥ 2 outpatient claims for epilepsy (ICD-9-CM 345.XX) were selected. Patients were required to receive treatment with ≥ 1 AED following their first epilepsy claim, with the first AED prescription as the index date. The index treatment was classified as either a controlled or non-controlled substance according to its Controlled Substance Act code (Schedule I - V were considered controlled substances). Patients were required to be ≥ 18 years of age at index, and not have any AED treatment in the baseline period. Demographics characteristics and comorbidities were evaluated at baseline. Adherence to any AED (controlled or non-controlled; medication possession ratio [MPR] ≥ 0.8) and total costs (all-cause medical and pharmacy) were assessed during follow-up and stratified by index treatment classification. Generalized linear models were used to assess the impact of controlled AEDs on adherence and total costs, controlling for confounding factors including age, gender, and common comorbid conditions such as Alzheimers disease, bipolar disorder, depression, and substance abuse.

Results: 30,592 patients met cohort selection criteria; 3,146 (10.3%) of whom initiated treatment with a controlled AED. Patients who initiated treatment with a controlled AED had a lower MPR, and a lower proportion of patients who were adherent to any AED during follow-up, compared to those with a non-controlled index AED (0.52 [0.35] vs. 0.64 [0.33] $p < 0.01$; 32.6% adherent vs. 46.3% adherent, respectively, $p < 0.01$). Average total costs were also slightly higher among patients initiating treatment with a controlled AED (\$22,528 vs. \$22,034, $p < 0.01$). In multivariate analyses, a statistically-significant higher probability of adherence to any AED (adjusted OR: 1.67; $p < 0.01$) and 6.7% lower total costs ($p < 0.01$) were observed for patients initiating treatment on non-controlled AEDs.

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Conclusion: Patients with epilepsy who initiated AED treatment with a controlled substance experienced lower levels of treatment adherence and higher all-cause medical costs compared to patients who initiated treatment with a non-controlled AED. Further examination of the medical/economic outcomes associated with controlled AEDs among patients with epilepsy is warranted.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Pharmacy-based distribution of intranasal naloxone: prevention of opioid overdose deaths in Massachusetts

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Purpose: Intranasal naloxone, an opioid overdose reversal agent, has been distributed through state-funded programs to bystanders and opioid abusers in Massachusetts for the past decade. In March of 2014, the Governor of Massachusetts declared the increase in opioid overdose deaths in Massachusetts an epidemic, calling for interventions to address this growing problem. The purpose of this project was to conduct a budget impact analysis to determine the financial implications of distributing intranasal naloxone through community pharmacies. By shifting the distribution of intranasal naloxone from state-funded programs into the retail pharmacy setting, the potential for a substantial positive impact to reduce opioid overdose deaths exists in Massachusetts.

Methods: Clinical evidence supporting the efficacy of intranasal naloxone versus other administration routes as well as evidence supporting the distribution of intranasal naloxone to the public was obtained via literature searches. The searches identified 14 applicable clinical studies and 3 applicable economic studies. Using this evidence, a decision-analysis model was constructed and estimated the financial impact on the Commonwealth of Massachusetts of funding intranasal naloxone distribution programs in community pharmacies over a two-year period. It was assumed that existing distribution programs would cease upon the start of the community pharmacy programs. Cost inputs included the price of intranasal naloxone kits and costs of three-hour training programs, which were estimated using the average pharmacists salary during this time period. In each month of Year One, a total of 1,000 intranasal naloxone kits would be allocated to fifty pharmacies throughout Massachusetts to distribute to addicts and their families and friends. During training sessions held each month, pharmacists would train these customers on the signs and symptoms of an overdose, the proper technique of administering intranasal naloxone, and the importance of calling EMS even after the drug is administered. Year Two would provide the same monthly distribution to a total of 150 pharmacies.

Results: Intranasal naloxone is equally effective as intramuscular and intravenous naloxone. Intranasal route of administration is an appropriate first-line treatment to reverse opioid overdose. Time from patient contact to response does not differ between administration routes;

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however, intranasal delivery is safer for administration by lay people and is also associated with fewer adverse effects. The budget impact analysis determined that if the Commonwealth of Massachusetts implemented intranasal naloxone distribution through pharmacies, an additional \$1,375,962 over two years would be required to distribute intranasal naloxone kits through 150 pharmacies in Massachusetts. Assuming that every person administered intranasal naloxone also receives EMS care, there would be an additional annual cost of \$1,098,915, resulting in a total program cost of \$2,474,877. Sensitivity analyses were conducted and it was determined that distributing naloxone through community pharmacies would be the least costly intervention with the potential for the greatest outreach. Previous studies on naloxone distribution have shown that this intervention is associated with increased education, decreased overdoses, and decreased overdose deaths. Distributing intranasal naloxone through pharmacies will provide even more widespread access and education that has the ability to further increase these positive outcomes.

Conclusion: Distribution of intranasal naloxone in pharmacies will reduce the number of deaths due to opioid overdose by decreasing the amount of time to access and administration of naloxone and increasing the education of opioid abusers and bystanders. Pharmacy-based distribution of intranasal naloxone kits is a life-saving, preventative measure for the Commonwealth of Massachusetts that deserves consideration. Although this program is not cost saving, it will save lives, which should be of utmost importance when considering its implementation and budget impact.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Extended stability of chlorothiazide vial reconstituted with bacterostatic water for injection

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Purpose: Chlorothiazide is a thiazide type diuretic that inhibits sodium re-absorption in the distal tubule, leading to increased excretion of sodium and water. Chlorothiazide can be administered intravenously (IV) as multiple intermittent doses or as a continuous infusion to achieve the desired level of diuresis. The package insert for chlorothiazide sodium injection recommends aseptic preparation for reconstitution and disposal of the unused vial portion that is not intended for immediate use. The use of IV chlorothiazide is usually prohibited due to the cost of this product. The purpose of this study was to determine if chlorothiazide is stable for 96 hours when reconstituted and stored in the manufacturers vial at 4C.

Methods: Chlorothiazide (500 mg vial APP Pharmaceuticals, Schaumburg, IL) was reconstituted with bacterostatic water for injection, USP (APP Pharmaceuticals, Schaumburg, IL), resulting in a final concentration of 28 mg/mL. The solution was visually examined for color change against a white background and for haze, turbidity, gas bubbles, and precipitation against a black background. These evaluations were done immediately and daily after the samples were stored at 4C in the dark for up to 96 hours to simulate storage under normal clinical use. Fresh control samples were prepared each day prior to liquid chromatography tandem mass spectroscopy (LC/MS/MS) analysis to account for daily variations in MS signals. Experimental values were adjusted based upon the fresh samples being 100% of the signal. Visual compatibility was defined as the absence of any haze, turbidity, precipitation, color change, or gas bubbles. Stability was defined as not less than 90% of the initial drug concentration remaining in the admixtures. The reference standard of chlorothiazide was obtained from USP (Rockville, MD) and dissolved in equimolar NaOH solution. Prior to the stability study, LC/MS/MS methods were developed to separate, detect and measure chlorothiazide. Chlorothiazide was detected using an Agilent 6460 Triple Quad LC/MS/MS equipped with an ESI source. MS conditions were: gas temperature 350C and flow rate 10 L/min; sheath gas temperature 400C, flow rate 12 L/min; nebulizer pressure 45 psi; capillary 3500 V and detector in negative ion mode. Chlorothiazide primary ion was 294- and fragment ion 214.1- with fragmentor set at 150 V and collision energy 12 eV.

Results: Chlorothiazide typically eluted from the chromatogram at 1.7 min. An initial dilution range was prepared to determine the linear range of the LC/MS/MS assay. The assay for chlorothiazide was linear from 80 to 2,000 ng/mL. The commercial sources of chlorothiazide retained 100% of the original concentration for the 96 hour duration of this study.

Conclusion: We conclude that chlorothiazide, when reconstituted with bacterostatic sterile water for injection at a concentration of 28mg/mL and stored at 4C, will retain > 90% of the original

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compound for at least 96 hours. The ability for a healthcare facility to utilize a beyond use date of up to 96 hours from preparation can result in a significant reduction in healthcare expenditures.

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6-143

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Analysis of predictors of hospital length of stay and all cause 30 days readmission among patients admitted with ischemic stroke

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Purpose: Stroke is the fourth leading cause of death and the second leading cause of disability. It is associated with increased inpatient cost. With increasing health care cost, readmissions and length of stay is an area of interest to policy makers and hospital administrators. The purpose of this study is to determine the predictors of hospital length of stay and readmissions among ischemic stroke patients, and to evaluate the impact of an implementation of an inpatient provision of a patient centered approach to medication therapy management service on hospital length of stay and readmission among acute-care ischemic stroke patients.

Methods: This two stage retrospective cohort study was conducted in a certified inpatient stroke center and approved by Institution Review Board (IRB). This study includes a retrospective review of all adult patients admitted from 2007-2013 with a diagnosis of ischemic stroke. In the first stage of the study, predictors of length of stay (LOS) and readmissions among ischemic stroke patients were modeled using ANOVA for continuous variable and logistic regression for dichotomous variable. In the second stage of the study, an inpatient medication therapy management service (acute care MTM) was implemented in 2011-2013 among patients diagnosed with ischemic stroke. The role of the MTM service was to ensure appropriate provision of medication reconciliation and optimization of all home and inpatient medications following evidence of improved outcome. Following a 12 month implementation of acute-care MTM, a computer generated random selection of patients from each 12-month time period (from 2007-2013) was performed and categorized according to the time period in which they were selected. In addition, patients were categorized to transient ischemic attack (TIA) or ischemic stroke (IS) as identified using ICD 9 codes. ANOVA was used to compare mean differences in LOS across the different time periods.

Results: In the first stage of the study, we analyzed a cohort of 700 patients with a population mean age centered at 65. Based on our analysis, the predictors for LOS was insurance type and severity ($P < 0.05$). There was a significant linear relationship between severity and LOS. On the other hand, the use of statin and age were significant predictors for all cause 30 days readmission ($P < 0.05$). Patients > 65 years old were likely to be readmitted compared to patients < 65 years old (OR 1.852 95% CI [1.122-3.056]). Similarly, patients who were not on statin upon discharge were more likely to be readmitted within 30 days (OR 2.19, 95% CI [1.017 -4.7]). In study stage 2, patients were categorized following time periods: 2007- 2008, 2008-2009, 2009-2010, 2010-2011, and 2011-2012 (intervention year). The mean difference in LOS from time period 2010-

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2011 (n= 101) compared to the intervention period 2011-2012 (n= 142) was -0.78 (95% CI [-1.99 to 0.43]P = 0.333). This slight decrease was not statistically significant. Furthermore, there was no significant mean differences in LOS and 30 days readmission across the other time periods as compared to the intervention year among TIA and IS group.

Conclusion: This retrospective analysis reveals that the predictors for readmission rates are age and statin use; while severity and insurance type were identified as predictors of LOS. This has an important implication as patient care services or predictive model that will translate to improved LOS and 30-day readmissions among ischemic stroke patients, in a system-wide institution, are developed. Implementation of inpatient MTM resulted to a small but non-significant reduction in LOS. We hypothesize that this observation will be different in an outpatient setting where an effective chronic management of risk factors associated with ischemic stroke are expected.

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6-144

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Clinical and pharmacoeconomic considerations of the sufentanil sublingual tablet system compared to intravenous patient-controlled analgesia

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Purpose: The sufentanil sublingual tablet system (SSTS; Zalviso, AcelRx Pharmaceuticals, Redwood City, CA) is a preprogrammed, non-invasive, secure bedside patient-controlled analgesia (PCA) system for treatment of moderate-to-severe pain in hospitalized patients. A safety and efficacy study of SSTS versus IV PCA morphine in postoperative patients following open abdominal surgery or joint replacement surgery was conducted as well as a pharmacoeconomic analysis of the costs of current IV PCA treatment to delineate the possible cost advantages of SSTS over this traditional standard of care.

Methods: In a Phase 3 randomized, open-label, non-inferiority trial at 26 US sites, adult inpatients after major open abdominal or orthopedic surgery (knee or hip replacement) were randomized 1:1 to SSTS or IV PCA for up to 72h, stratified by age and type of surgery. The 48-hr Patient Global Assessment (PGA-48) using a 4-point scale (poor, fair, good, excellent), comparing the proportion of patients who responded good or excellent (collectively success) in each treatment arm was defined as the primary endpoint. Up to 390 patients were to be enrolled to ensure at least 176 patients per group received treatment and had available data for analysis (90% power to demonstrate therapeutic non-inferiority). A 95% confidence interval (CI) of the difference in success rate between two treatment groups was constructed and if the lower boundary of this CI was not less than -15%, SSTS would be considered non-inferior to IV PCA. In addition, retrospective, descriptive analyses using the Premier database (2010-2012) were conducted on cost of IV PCA after total knee/hip arthroplasty (TKA/THA) or open abdominal surgeries. Weighted average cost of equipment and opioid drug and literature-based cost of adverse events and complications was aggregated for total costs.

Results: In the Phase 3 study, 357 patients received study drug (ITT population: SSTS [n=177] and IV PCA [n=180]). The mean age for the SSTS group was 63.8 years (30.5% males) and IV PCA group was 64.0 yrs (40% males). Overall, 78.5% vs. 65.6% of patients achieved PGA-48 success for the SSTS group vs. IV PCA group, respectively, demonstrating both non-inferiority based on the 95% CI ($p < 0.001$) as well as statistical superiority in favor of the SSTS ($p=0.007$). The SSTS group showed earlier pain control than the IV PCA group at 1, 2, and 4h ($p < 0.01$) as well as higher patient and nurse ease-of-care scores. While overall adverse events were similar, the SSTS group had fewer patients experiencing oxygen desaturations below 95% compared to the IV PCA group ($p=0.028$). In the Premier database analysis, of 11,805,513 total patients,

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272,443 (2.3%), 139,275 (1.2%) and 195,062 (1.7%) patients had TKA, THA and abdominal surgeries, respectively. Mean IV PCA equipment and opioid cost per patient over the 48-hour following surgery was \$196 (THA), \$204 (TKA) and \$243 (abdominal), with total costs, including infection risk, complications and IV PCA errors ranging from \$647 to \$694 per patient.

Conclusion: SSTS provides rapid pain control and higher patient and nurse ease-of-care ratings in the postoperative setting and since it is preprogrammed and utilizes the sublingual route, SSTS avoids the programming errors and complications due to the invasive route of IV PCA drug delivery. Traditional IV PCA drug and equipment costs are not insignificant and can average just over \$100 per day with a range through \$300 per day when factoring in IV PCA-related adverse events. SSTS could represent a significant improvement over the current standard of care as well as decrease overall costs associated with patient-controlled analgesia systems.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Pharmacist led inpatient discharge counseling: a pilot study

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Purpose: Discharge counseling is currently conducted by nursing at our institution. This study targeted high risk patients for discharge education to evaluate the impact of a pharmacist driven service on medication comprehension and hospital reutilization.

Methods: This was a prospective, single center, institutional review board approved study conducted January to April 2014 in adult patients discharged to home from a general medical floor and on at least 5 medications, including an anticoagulant or dual antiplatelet agents. Patients identified through a hospital wide discharge queue underwent a pre, post, and follow up (2 to 4 week post discharge via telephone) medication comprehension survey, education session, and medication review by the pharmacy resident. Patients were followed up to 30 days post discharge to assess for hospital reutilization. Pertinent data, including pharmacist time involvement and clinical interventions, were also recorded.

Results: Patient medication comprehension survey scores improved after the pharmacist led discharge counseling session (2.1 versus 4.7, p less than 0.0001). The scores at follow up did not significantly differ from post education in the 21 patients surveyed (5.71 versus 5.76, p equals 0.8). Six of 28 counseled patients presented again within 30 days of discharge. Of these, 2 out of 6 cases were due to a potential medication related effect (1 emergency department and 1 readmission). The average pharmacist time involvement in the process was 30.9 minutes, and a total of 16 discharge regimen clinical interventions were performed in the 28 patients counseled.

Conclusion: Patient discharge medication comprehension improved after pharmacist discharge counseling, and this effect was sustained 2 to 4 weeks post discharge. While the data is equivocal regarding impact on readmission rates, pharmacist involvement in the discharge process allowed for the identification and resolution of discharge drug therapy issues through clinical interventions.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of liposomal bupivacaine on perioperative outcomes following unilateral total knee arthroplasty

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Purpose: Postsurgical pain following total knee arthroplasty (TKA) is commonly managed with femoral nerve blocks and patient-controlled analgesia (PCA) devices delivering opioids. However, opioids can cause a variety of side effects, including nausea, vomiting, and sedation, which can hinder physical therapy, delay discharge, and prolong hospital length of stay (LOS). A single dose of liposomal bupivacaine (LB) administered by infiltration at the surgical site is intended to provide postsurgical analgesia for up to 72 hours and minimize the use of postsurgical opioids. The objective of this study was to assess the impact of LB on perioperative outcomes following unilateral TKA.

Methods: A retrospective observational study was conducted at a regional medical center in the southern United States to compare perioperative outcomes in a convenience sample of patients who underwent unilateral TKA with LB over a 3 month period (LB group) to those who underwent unilateral TKA with femoral nerve block with or without PCA and opioids in a prior 3 month period (control group). Data were obtained from clinical and administrative records. Perioperative outcomes included time spent in the post-anesthesia care unit (PACU), LOS, opioid consumption (mg intravenous morphine equivalent (ME)), and hospital charges for analgesic medications. Outcomes were compared between groups using students t test, with significance set at $\alpha=0.05$.

Results: The study reviewed data for a total of 200 patients, including 100 in the LB group and 100 in the control group. Patients in the control group received femoral nerve block (60%), femoral nerve block and PCA opioids (38%), or PCA opioids only (2%) for postsurgical analgesia; no patients in the LB group received femoral nerve block or PCA opioids. There were no significant differences between the LB group and control group in patient age (mean 68.1 vs. 68.6), bodyweight (92.8kg vs. 87.7kg), or female gender (62% vs. 64%). Patients in the LB group spent 33.1% less time in the PACU (74.7 vs. 111.7 minutes; $p<0.05$) and had a shorter LOS (2.9 vs. 3.3 days; $p<0.05$) than those in the control group. Patients in the LB group also used 81.3% less opioids (38.8 vs. 207.5 mg ME; $p<0.05$) and their charges for analgesic medications were 29.6% lower (\$1,010 vs. \$1,436; $p<0.05$) than those in the control group. Three patients in the control group required naloxone, while none did in the LB group.

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Conclusion: Patients undergoing unilateral TKA who received a single dose of LB at the surgical site without femoral nerve block or PCA opioids had significantly better perioperative outcomes, including PACU time, LOS, opioid use, and hospital charges for analgesic medications, than patients who received femoral nerve blocks with or without PCA opioids for unilateral TKA. Replacing femoral nerve block with or without PCA opioids with LB infiltration appears to offer substantial advantages for postsurgical analgesia.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Budget impact analysis of sumatriptan/naproxen versus sumatriptan from a MassHealth perspective

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Purpose: This budget impact analysis (BIA) serves to evaluate the economic impact of sumatriptan/naproxen (Treximet) on the budget holder, MassHealth, with regard to emergency department visits, physician visits, hospitalizations, and drug costs. Although generic sumatriptan is on the formulary, MassHealth currently requires a prior authorization to be processed before Treximet will be covered. The purpose of this BIA is to determine if it is necessary to have physicians complete a prior authorization in order for a patient to have access to Treximet.

Methods: A literature search was conducted to obtain both clinical and economic sources. Ultimately, eleven clinical sources and nine economic sources were evaluated to determine the clinical efficacy and economic efficiency of Treximet compared to sumatriptan. Using data found via the literature search, a budget impact analysis was done from a MassHealth perspective. The national prevalence rate of migraineurs of 13% was applied to the 1.4 million MassHealth enrollees as of 2014. Assuming that all the sick population is treated, the target population is 182,000 migraineurs. This analysis explored the impact of both Treximet and sumatriptan on the budget per attack and over a 12-month period using an average of 36.5 attacks per year. When calculating costs, only relevant information from a MassHealth perspective was incorporated, including cost of medication, cost of physician visit, cost of emergency department visit, and cost of hospitalization. Factors such as missed work time and lost productivity costs were not included because the budget holder is not affected by such costs. Since the adverse event profiles of both treatment options are similar, the cost of adverse events was not included in the analysis.

Results: While the components of Treximet are available as two separate drug regimens, the combination in a single dose tablet provides advantageous pharmacokinetic properties that provide patients with a decreased time to headache relief, increased headache relief at two hours, and greater satisfaction of therapy compared to its individual components or placebo. Treximet costs about \$27.80 per tablet compared with \$1.77 for sumatriptan. Although more expensive, approximately 61% of patients are relieved with Treximet while only 52.5% are relieved with sumatriptan. In addition to drug costs, after taking into consideration other direct costs such as physician visits, emergency department visits, and hospitalizations, Treximet is shown to be the more costly alternative. Based on the budget impact analysis, sumatriptan costs MassHealth 159

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million dollars annually per target population and 878 dollars annually per patient. Treximet would cost 306 million dollars annually per target population and 1,682 dollars annually per patient. It would cost MassHealth an additional 804 dollars annually per patient or 146 million dollars annually per target population to add Treximet to the formulary without requiring a prior authorization.

Conclusion: Treximet is more efficacious than sumatriptan for the treatment of acute migraines. Despite showing superior clinical efficacy, the high drug costs associated with Treximet outweigh the reduction in healthcare resource utilization. Since it would cost MassHealth about 146 million additional dollars annually per target population, it would not be beneficial to cover Treximet for patients without requiring an adequate trial of sumatriptan monotherapy. Although this budget impact has some notable limitations, the sensitivity analysis proves that sumatriptan is more cost efficient compared to Treximet. When considering the scope of MassHealth's expenses, Treximet would consume a greater portion of the budget.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Assessment of medication discrepancies in admission medication histories in a 184-bed community hospital

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Purpose: Medication errors during transition of care, including hospital admission and discharge, can lead to adverse drug events (ADEs). The errors in patients admission medication histories can arise from various reasons such as time constraints, patients or family being poor historians, and inaccurate medication records. Pharmacist- or pharmacy technician-involved interventions on completing admission medication history have been shown to improve outcomes, such as fewer medication discrepancies and decreased potential ADEs. The purpose of this study is to assess the outcomes of a pharmacy-led admission medication history review pilot.

Methods: This prospective observational study was conducted from October 2013 to March 2014 at CHI St. Lukes The Woodlands Hospital (SLWH), a 184-bed acute care community hospital located in The Woodlands, Texas. During the study period, SLWH had 2259 adult visits per month at the Emergency Department and 879 adult admissions per month. The inclusion criteria of this study were patients older than 18 years, admitted to hospital within the past 72 hours, and initial medication history completed by a nurse or other healthcare professional. Priority was placed on patients who took at least one high risk medication. At least two reliable sources of information were explored for the high-risk medications before documenting in the institution electronic medication record. High risk medications and reliable sources of information were pre-defined in a pharmacy protocol approved by institutional Pharmacy & Therapeutics Committee. Descriptive statistical analyses were performed.

Results: During the six-month study period, pharmacists reviewed 845 adult patients admission medication histories, which accounts for 16% of adult patients admitted to SLWH. A total of 7104 prior-to-admission medication entries were reviewed; 3224 medication discrepancies (45%) were found and subsequent corrections were made. On average, 8.4 medications were documented per medication history by other healthcare professionals, mostly nurses, and 3.8 medication discrepancies per medication history were corrected by pharmacists. Among these discrepancies, 36% were medication omissions, 22% were medications patients were not

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currently taking, and 42% were inaccurate documentation such as incorrect dose, frequency, or formulation. Among the patients interviewed, 18% of them had no discrepancies in their medication histories, 40% had one to three discrepancies, 23% had four to six discrepancies, and 20% had seven or more discrepancies. Literature demonstrated that about 0.9% of medication errors result in an ADE and that one ADE was associated with an increase in cost of \$3,244.5. Therefore, the six month pilot was associated with a potential cost avoidance \$94,128.

Conclusion: This study raised awareness of the discrepancies in admission medication histories at an acute care community hospital. Although only 16% of admission medication histories were audited by pharmacists, 82% of these medication histories contained at least one discrepancy. Based on the study results, we proposed the addition of one FTE pharmacist and one FTE pharmacy technician to improve the admission medication history documentation process. A future study will focus on the improvement of accuracy of the admission medication histories with additional pharmacy personnel involvement.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Levetiracetam as monotherapy in the treatment of adults with generalized tonic-clonic seizures: a budget impact analysis from the MassHealth perspective.

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Purpose: Levetiracetam is only FDA approved as adjunct treatment for seizure disorders but it is commonly used off label as monotherapy. This is because compared to antiepileptic drugs (AED) currently FDA approved for first line monotherapy use it has a lower incidence of adverse events (AE) and no required serum monitoring associated with it. The study's purpose was to determine if levetiracetam should be considered for first line monotherapy use by reviewing clinical efficacy data, adverse events, tolerability and monitoring parameters. Then to create a budget impact analysis (BIA) to help MassHealth decision makers decide if levetiracetam is worth the cost.

Methods: Literature searches of clinical efficacy of levetiracetam, lamotrigine, oxcarbazepam, and topiramate were done. Medications other than levetiracetam were chosen because they are already FDA approved for first line monotherapy treatment of generalized tonic-clonic seizures. Lamotrigine has less adverse events, more tolerability and no required serum drug monitoring making it the best comparator to levetiracetam. Original searches for studies about lamotrigine or levetiracetam being used as monotherapy had to be expanded to include adjunct use data due to a lack of available data. Literature searches found 15 studies that fit the inclusion criteria but 6 were then excluded. Of the 6 excluded 4 were excluded because they only pertained to partial seizures and not generalized tonic-clonic seizures. The other 2 trials were excluded because 1 involved a population outside of target population age range of 18 to 64 years old and the other because it pertained to intractable epilepsy while the focus of our study was on generalized tonic-clonic seizures, making it inappropriate to include. Regarding data found pertaining to the economic evidence to support levetiracetam use as first line monotherapy option 4 eligible studies were found that had data regarding the cost of adverse events and monitoring.

Results: Resulting from our literature searches and reviews we found levetiracetam was not significantly more or less efficacious than current first line monotherapy treatment options for patients with generalized tonic-clonic seizures. Since lamotrigine was recommended based on three trials that only demonstrated equivalence to standard AEDs we feel the equivalence also demonstrated by levetiracetam also justifies its use as a potential first line monotherapy option for patients with generalized tonic-clonic seizures. Currently we have found there is a lack of

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available economic evidence regarding the levetiracetam use as a first line monotherapy option. The economic evidence we found, supports the cost effectiveness of levetiracetam when it is a second line option or when adverse events are taken into account.

Conclusion: Based on the clinical and economic data we identified as well as the cost difference between lamotrigine and levetiracetam we believe levetiracetam should be considered to be a first line monotherapy option for the treatment of generalized tonic-clonic seizures. The strength of this conclusion is limited thought due to a lack of available data. Furthermore the results of the BIA suggest levetiracetam to be more costly option by approximately \$1,200 to \$2,000 per patient per year in comparison to lamotrigine.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Cognitive behavioral therapy combined with fluoxetine in adolescents with major depressive disorder: a budget impact analysis from a MassHealth perspective

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Purpose: Major Depressive Disorder (MDD) is a leading cause of disability among Americans with 11% of adolescents diagnosed by age 18. This has resulted in significant costs for many American health systems. The clinical efficacy of both cognitive behavioral therapy (CBT) and selective serotonin reuptake inhibitors has been shown, but less is known about the economic aspect of these treatments. This study analyzes the budget impact of the use of fluoxetine monotherapy versus the combination of fluoxetine and CBT from a MassHealth perspective.

Methods: A literature review identified four economic and ten clinical articles published from 2004 to 2011 using Medline and PubMed databases. The study population was limited to adolescents, ages 11-19 years, newly diagnosed with MDD, covered by MassHealth, and treated with fluoxetine, CBT, or both producing an estimated population of 21,245 adolescents. This budget impact analysis utilized Microsoft Excel. Values were collected from MassHealth rates of payment as of January 2014 for medication, therapy, and physician visits. Clinical literature results were utilized to determine average costs of hospitalization, adherence to treatment, and the difference in clinical outcomes between arms. Incidence and associated cost of suicide were also utilized to analyze cost impact given the potential significant risk among depressed adolescents using antidepressants. A base case simulation accounted for the total cost of all inputs for the population taking only fluoxetine. A second total for this population was calculated accounting for combination therapy with CBT. These costs were compared to determine which arm more significantly impacted the final budget. Sensitivity analyses considered the variability in the cost of fluoxetine, hospitalization, primary care physician (PCP) visits, and adherence to fluoxetine and CBT. All necessary costs were adjusted to 2014 \$USD.

Results: While fluoxetine has proven clinical efficacy, the addition of CBT results in further positive clinical outcomes, such as reductions in hospitalization, need for physician appointments, and perhaps most importantly, suicide rate. Prior to CBT introduction, MassHealth is prospectively to pay \$122,811,644 (\$6,508/patient) for a population of adolescents with depression taking fluoxetine. Following introduction of CBT, this cost is reduced to \$114,147,404 (\$5858/patient), a negative difference of \$8,664,240 and about 7.05%. This reduction in cost was the result of decreased need and subsequent cost of PCP visits and hospitalization. Suicide and associated costs were also found to decrease in the setting of combined therapy with CBT. Sensitivity analyses reveal that potential fluctuation in final costs

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may be most heavily attributed to the range of potential PCP costs depending on where the adolescent receives periodic care throughout the first year of treatment. This results in a potential range from \$5139 to \$6485 per patient.

Conclusion: The results of this analysis suggest that initial therapy with CBT in combination with fluoxetine provides more positive economic outcomes than fluoxetine alone in a single fiscal year. Mental illness is highly prevalent among MassHealth users and research regarding adolescents is currently lacking. While several assumptions exist in this analysis, the consideration of this cost reduction by MassHealth and additional Medicaid payers may result in savings both at the state and national level and provide further research of an underrepresented population treated within this health system.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Budget impact analysis of tamoxifen and raloxifene for chemoprevention of breast cancer in high-risk women: a MassHealth perspective

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Purpose: Women who are at high risk for breast cancer have preventative options that include two selective estrogen receptor modulators that are FDA approved for chemoprevention of breast cancer, tamoxifen and raloxifene. Since the U.S. Preventative Services Task Force is recommending clinicians to offer chemoprevention to high-risk women, the Affordable Care Act implemented these recommendations and is requiring insurance companies to cover the cost for chemoprevention. This may have an impact on their budget due to the possible increase in interest from patients. This analysis will help examine the costs that MassHealth would incur due to this new policy.

Methods: The inputs for the population included in this analysis were high-risk women covered under MassHealth that were ≥ 35 years old, had at least a 5-year predicted breast cancer risk of 1.66% based on the Gail model, and no predisposition to thromboembolic events. This was further divided into pre- and post-menopausal women with a sub-group of post-menopausal women with osteoporosis, and those ≥ 65 years old with Medicare as their primary insurance. The population was divided into groups that would or would not receive chemoprevention based off of prevalence data gathered from observational studies. The inputs for costs were based off of major side effects and their respective incidence rates from a landmark noninferiority trial of these two agents. The costs were determined from various sources including MassHealth, NCI, and observational studies. Sensitivity analyses were conducted on adherence and pertinent side effect costs due to the cost variability and large difference in incidence between tamoxifen and raloxifene. The time horizon for this analysis was one year and the budget impact analysis was conducted in Excel. Primary results compared the total cost before and after implementing raloxifene for MassHealth, and secondary results were notable differences found in the sensitivity analyses.

Results: In the base case analysis, the total cost for MassHealth before the addition of raloxifene was \$228,051,972, which increased to \$228,436,997 after its implementation, resulting in a \$385,025 difference. This increase is due to the slightly higher incidence of breast cancer in those that take raloxifene as well as its higher cost. Since the incidence of side effects of

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raloxifene are lower in comparison to tamoxifen, the costs attributed to side effects alone were lower following the implementation of raloxifene, resulting in a \$41,144 cost savings. One sensitivity analysis showed that with lower adherence, the total cost for MassHealth was lower compared to the base case. In the before scenario, the adherence cost range for side effects was \$109,553 to \$255,624. In the after scenario, the adherence cost range was \$84,867 to \$197,844. Although both a higher and lower range was applied to the adherence data used in the base case, the lower range scenario is most likely to be seen in clinical practice, and therefore the most likely total cost for MassHealth. Therefore, we found that the most likely total cost for MassHealth was \$228,219,352. Similar trends were seen in MassHealth seniors with Medicare as their primary insurance.

Conclusion: Our budget impact analysis showed that the addition of raloxifene into the intervention mix caused the total costs for MassHealth to increase due to the higher cost of raloxifene and the slight increase in breast cancer incidence when compared to tamoxifen. Despite the increase in total cost, the costs for side effects were lower in the after scenario due to raloxifenes better side effect profile. Overall, the low adherence sensitivity analysis would be considered the most realistic scenario and resulted in a total cost of \$228M with a cost difference before and after of \$231,051.

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Financial impact of the decentralized clinical staff pharmacist in a large community hospital

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Purpose: Healthcare costs and patient care are constantly evaluated in the institutional setting. Each topic is dependent on the other when it comes to providing healthcare for our patients. An improperly managed budget will ultimately result in the demise of the institution and negatively affect patient care. This project focused on implementing a decentralized pharmacist in nursing units to provide medication knowledge, patient education, and control costs as compared to nursing units not serviced by a decentralized pharmacist.

Methods: In 2012, our hospital's inpatient pharmacy implemented a new strategy to better serve our patients. Clinical staff pharmacists were decentralized from the main pharmacy to a pilot nursing unit, and would later expand to the entire floor if the pilot unit was found to be successful. Plans were also in place to move to an additional nursing floor if the project was deemed to be worthwhile. The decentralized pharmacists were responsible for: ensuring accurate medication order evaluation, being an accessible resource for medication information for providers and patients, making certain that medications were delivered on time, and providing a renal monitoring service. These duties served as an active action of the organization's mission statement and was a useful tool in decreasing the individual nursing unit costs. This was accomplished by increasing the efficiency between the pharmacy and nursing staff. A budget report was prepared which compared the financial costs of each nursing unit before and after decentralization of services was implemented.

Results: The pharmacy department began to see subjective improvements almost immediately after implementation in terms of professional relationships with other disciplines, being more integrated into patient care, and having more direct patient contact. After one year, not only had a new patient care service been implemented, financial impacts were also realized. The initial pilot nursing unit realized savings over \$14,000 in pharmaceutical costs. Data collection for the additional nursing floor were also extremely positive.

Conclusion: Decentralization of the clinical staff pharmacist at our hospital provided multiple opportunities to enhance patient care. The improved relationships between pharmacy and nursing staff allowed for a more efficient work flow and collaborative work environment. These efforts helped reduce pharmaceutical budget costs on the initial pilot unit and expanded nursing floor.

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Professional Poster Abstract

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Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Burden of Untreated Patients with Epilepsy: a Retrospective Study in a Commercially-Insured US Population

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Purpose: This analysis was designed to evaluate the economic and health care resource burden among untreated epilepsy patients compared with patients treated with one or more anti-epilepsy drugs (AEDs).

Methods: The MarketScan retrospective database was used including data from January, 2006 to December, 2011. Selecting patients with at least one diagnosis code for epilepsy (International classification of disease revision 9 code 345.xx), were 18 years or older, and minimum continuous enrolment of 365 days. Patients were grouped into the treated or untreated cohorts based on the number of AEDs received concurrently during the observation period. A 30-day period of concurrent administration was required for an AED to be defined as an adjunct medication. The medical (i.e. hospitalizations, length of hospital stay, emergency room (ER) visits, neurologist visits, and other healthcare services) and pharmacy resource utilization (AEDs and non-AEDs) was compared between treated and untreated patient cohorts. Costs were adjusted using the US consumer price index, 2013 values. Adjusted cost differences (ACD) and 95% confidence interval (CI) were estimated using a multivariate linear regression. Adjusted incidence rate ratios (IRR) differences were estimated using a conditional multivariate Poisson regression.

Results: Of a total of 745,504 patients diagnosed with epilepsy, 504,504 (68%; mean age 48 years; 57 percent female, average follow-up 1,052 days) were included in the analysis. Of these, 176,691 patients (35%) were in the Untreated cohort, 153,982 patients were in the One AED cohort (30.5%), and 22.7%, 8.8% and 3.0% were in the Two, Three, and Four or more AED cohorts, respectively. The Untreated cohort had significantly more hospital admissions, more ER and neurologist visits, and longer hospital stays compared to the One AED cohort, but significantly lower utilization of these same health care services compared to the Two, Three, and Four or more AED cohorts (; all $p < 0.001$, except for Untreated vs. Two AED: $p = .34$). Medical resource utilization in the cohorts was positively correlated with the number of AED treatments received (Spearman correlation coefficient 0.30). The share of total healthcare costs also increased with the number of AEDs: Untreated, \$74,566 (15.0%); One AED, \$81,815 (16.4%); Two AEDs, \$95,416 (19.1%); Three AEDs, \$110,528 (22.2%); Four or more AEDs, \$136,426 (27.4%)($p < 0.0001$ for all comparisons).

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Conclusion: In this study, untreated patients had a greater utilization of health care services compared to monotherapy patients, and accounted for 15% of the study populations total healthcare costs. Conversely, patients receiving three or more AEDs had higher health care resource utilization rates, and accounted for approximately 50% of total healthcare costs. These results underscore the high unmet need among both untreated patients, and among patients requiring multiple AEDs for their epilepsy management.

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Professional Poster Abstract

6-154

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Levetiracetam vs. valproic acid in the treatment of benzodiazepine-refractory status epilepticus: a budget impact analysis

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Purpose: Status epilepticus (SE) is a condition which can lead to significant morbidity and mortality when left untreated. Typical first line agents include benzodiazepines. Therapy for SE that is refractory to benzodiazepines is not well established. Some options include levetiracetam and valproic acid. It is currently unknown how these two therapies would compare in terms of their budget impact from a MassHealth payer perspective. We sought to perform a budget impact analysis to determine how each intervention would affect the MassHealth system.

Methods: We conducted a literature search using Medline Ebscohost as our primary database. A search of Status-epilepticus AND levetiracetam AND valproic acid yielded 37 search results, 8 of which were included for analysis. A search of cost AND levetiracetam and a search of cost AND valproic acid collectively yielded 135 studies, 4 of which were included for analysis. From these search results, a budget impact analysis was created using MassHealth as the payer perspective. Our population was based on the prevalence of status epilepticus among MassHealth patients (N=223). Time horizon was determined to be 5 years to provide an adequate reflection of an impact on the MassHealth budget.

Results: Our study demonstrated levetiracetams superior impact on MassHealths budget with a total cost savings of \$4,111,239 per year, or \$18,436 per person per year. The direct cost of the medications was found to be comparable. Disparity of costs was largest due to indirect costs of adverse events, treatment failure, and complications due to refractory therapy associated with valproic acid. The increased efficacy of levetiracetam and the decreased number of adverse events associated with it lead to a cost savings from a MassHealth perspective.

Conclusion: Based on the available clinical and economic literature, levetiracetam was shown to have larger cost savings on the MassHealth budget along with having increased efficacy and decreased adverse effects which make it an appropriate selection from a clinical and budgetary point of view when selecting therapy for benzodiazepine-refractory status epilepticus.

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Professional Poster Abstract

6-155

Category: Preceptor Skills

Title: Assessment of needs of preceptor development in post-graduate pharmacy residency programs.

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Purpose: The School of Pharmacy (SOP) has long been collaborating with healthcare institutions in our area to develop post-graduate pharmacy (PGY1) residency programs. Development of pharmacists into proficient resident preceptors, is an important component of the ASHP PGY1 Residency Program Accreditation Standard. Many of our collaborative programs look to the SOP for preceptor development needs. With the increasing in number of residency programs established in the past few years, the SOP is working towards creating a more formalized preceptor development programs. We conducted a survey to explore the needs for preceptor development of the different residency programs

Methods: Based on the ASHP PGY1 Residency Program Accreditation Standard for qualifications of being a resident preceptor, a nine items survey was constructed to evaluate: 1. The extent of involvement in residency training of each preceptor completing the survey; 2. Requirements of each residency program to become resident preceptors and to maintain preceptor status; 3. Types and format of preceptor development programs of interest; and 4. Major perceived challenges in residency precepting. All residency program directors and preceptors of our the 10 collaborative PGY1 programs were invited to participate. The survey was delivered via an online program. Completion of the survey was voluntary and anonymous. Results of the survey will be utilized to drive our future efforts in preceptor development. This project was approved by the SOP Institution Review Board.

Results: Thirty-five residency program directors/preceptors completed the survey. Twenty-four (73%) of them precepted direct patient care/clinical rotation; 11 (33%) administration rotation, 5 (15%) medication distribution, 5(15%) research rotation, and 3 (9%) longitudinal ambulatory care, teaching and/or medication safety rotation. Each preceptor has a resident with them anywhere from 3 weeks to five months of the year. The top three areas where preceptors perceived as most beneficial in terms of development were 1. Providing constructive feedback and evaluations; 2. Becoming an effective preceptor; and 3. Implementation of new pharmacy service. The most challenging aspect perceived by the preceptors in working with residents is overwhelmingly the lack of time (28 preceptors [93%]). Twenty-six (79%) of the preceptors also stated that training residents was not built into part of their job responsibilities and they had to

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make their own time. Once became a resident preceptor, almost half of the preceptors (16 [48%]) reported that there was no particular requirement to maintain preceptor status, nor developing other pharmacists to become preceptors. Eight (24%) of preceptors stated that they are required to attend continuing education programs relating to resident precepting.

Conclusion: Preceptor development is an important component of a successful pharmacy residency program. The ASHP accreditation standard provides guidelines on qualification in becoming a resident preceptor. However, many of our collaborative residency programs would like a more structured approach in preceptor development and how to maintain their proficiency. Results of this survey also indicated that, assisting preceptors to more effectively incorporate residents into their practice and to provide constructive feedback were the two most popular areas of guidance needed.

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6-156

Category: Preceptor Skills

Title: Implementation of a postgraduate year one pharmacy residency preceptor rotation

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Purpose: The American Society of Health-System Pharmacists (ASHP) currently requires 4 of 7 criteria be met in order to become a qualified pharmacy residency preceptor. Seventy-seven percent of postgraduate year one (PGY1) ASHP accredited residency programs are partially compliant in meeting these criteria. An ASHP accredited PGY1 pharmacy residency program in a community hospital desired to provide an opportunity for initial preceptor development as part of its required rotations. The residency program's goal was to provide additional opportunities to engage residents in all aspects of qualified preceptorship to supplement residency learning objectives and the college of pharmacy teaching certificate program.

Methods: The preceptor rotation was developed by a pharmacy practice faculty member with her practice site located at the institution. The rotation was based on the ASHP residency preceptor requirements that could be experienced during a 6 week rotation. The intent of the rotation was to fully engage residents in clinical practice, teaching, scholarship, and service at the preceptor level. Syllabus requirements for the rotation included educating patients, P4 students, and health care professionals. Clinical responsibilities, working on projects for the ASHP state affiliate, and providing a peer review of a professional article submission were also an integral part of the resident learning experience. Topic discussions were based on the learning needs of each resident as well as preceptor identified areas for improvement. Two residents were provided a post rotation survey utilizing a 5 point Likert scale to reflect on the impact of the preceptor rotation. Residents' perceptions of abilities were compared before and after the rotation based on mean scores. Survey scores were obtained for the following: overall effectiveness to become a qualified residency preceptor, professional organization participation, teaching effectiveness, and manuscript review ability.

Results: Mean scores for overall effectiveness to become a qualified residency preceptor increased from 2.5 to 4.5 after the preceptor rotation. Mean scores for professional organization participation and teaching effectiveness both improved from 3 to 4.5. Ability to review manuscripts increased from an average score of 3 to 4.

Conclusion: A PGY1 pharmacy preceptor rotation improved residents' perceptions of their ability to become a qualified residency preceptor.

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6-157

Category: Preceptor Skills

Title: Curriculum vitae evaluation of residency candidate applications for post-graduate year two (PGY2) pediatric pharmacy residency programs

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Purpose: Principle 1 of the American Society of Health System Pharmacists accreditation standards describes the qualifications of the resident application process: "Residency applicant qualifications will be evaluated by the residency program director (RPD) through an established, formal procedure...criteria used to evaluate applicants must be documented and understood by all involved in the evaluation and ranking process." The study purpose is to describe the components of the candidates' curriculum vitae included in candidate evaluations and determine the weight of each component for PGY2 pediatric pharmacy residency programs.

Methods: A list of PGY2 pediatric pharmacy residency programs with candidate and accredited status were identified from the residency directory available on ASHP's website. A link to an anonymous web-based questionnaire was sent to each residency program director (RPD) via email with a cover letter in order to indicate to the program director that this was a research endeavor. A reminder email was sent weekly for two weeks. The survey was closed after one month. Questions covered the practice of the residency programs application process including: the use of the early commitment process, the use of a formal rubric for candidate evaluation, the components of an application utilized to evaluation candidates, and the weight of each component for evaluation. For the purpose of this presentation, data from curriculum vitae evaluation will be presented. This study was approved by the local institutional review board.

Results: The email with a link to the questionnaire was sent to 42 residency program directors for PGY2 pediatric pharmacy residency programs. 28 (66.7%) of the RPDs responded to the survey. 67.8% (19/28) of respondents indicated that post graduate year one (PGY1) learning experiences had the greatest weight when evaluating candidates' curriculum vitae. Other components rated as having the greatest weight included pharmacy work experience (10/28), and candidate presentations (4/28). 71.4% (20/28) of respondents indicated that research experience had moderate weight when evaluating candidates' curriculum vitae. Additional items rated as having moderate weight included presentations (18/28), professional organization involvement (18/28), advance pharmacy practice experiences (16/28), pharmacy work experience (16/28), and volunteer involvement (10/28). 57.1% (16/28) of respondents indicated that volunteer experience had little weight when evaluating candidates' curriculum vitae. Other components rated as having little weight included non-pharmacy work experience (12/28) and introductory pharmacy practice learning experiences (11/28). Eleven programs responded that IPPE learning

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experiences were not evaluated at all. Other items that programs stated that were evaluated that were not stated on the survey included: teaching experience, location of the PGY1 residency, awards, and previous degrees.

Conclusion: As the pharmacy residency application process evolves and permits more information to be gathered, RPDs will have to prioritize the collected data. The top criteria receiving the most weight when evaluating a candidate's curriculum vitae were PGY1 learning experiences, pharmacy work experience, research experience, and presentations. With the high impact factor of PGY1 learning experiences on evaluation, it is highly important that the PGY1 resident participate in a program that will allow for a variety of pediatric learning experiences. This will assist a PGY1 resident planning progression to a PGY2 pediatric pharmacy residency.

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Category: Preceptor Skills

Title: Pharmaceutical care of the surgical patient module for pharmacy and medical students - integrating practice into academia

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Purpose: Pharmaceutical care of the surgical patient is taught in a fragmented way in the undergraduate course which anecdotally results in lack of knowledge and skills in preregistration and foundation pharmacists. Students are unaware of the rewarding nature of pharmacists' contribution to surgical patient care and do not appreciate the complexity of pharmaceutical care as part of the multidisciplinary surgical team. To increase the awareness of this area a collaborative approach by academia and practice was taken. Pharmacy and medical students were offered a dedicated module containing formal lectures and ward based clinical placements delivered by multidisciplinary specialists.

Methods: The academic teacher and the lead surgical pharmacist assembled a multidisciplinary module team comprising of Nutritional Support Team Consultant, Clinical Nurse Specialist Acute Pain and specialist pharmacists in antimicrobial therapy, surgery and critical appraisal. Several postgraduate surgical syllabi were consulted in the absence of a national framework for surgical care and aligned with the current undergraduate syllabus to add depth. Approval was sought from the medical and the pharmacy academic institutions for the module. Medical and pharmacy performance assessment tools were critically appraised to identify the appropriate tools to assess how students apply the pharmaceutical care process to surgical patients. Students performances were assessed with the chosen tools. Students completed the 14 statement on-line questionnaire used for all final year pharmacy modules to evaluate their satisfaction with the module and assessment tools. The questionnaire had a series of statements with a four point Likert scale, which was anchored by extreme descriptors (1 = definitely agree and 4 = definitely disagree). In addition students were asked to identify good aspects of the modules and any areas for improvement. The qualitative comments were thematically analysed.

Results: The proposed syllabus was approved by the two academic institutions. The outcome measures agreed were ability to apply principles of surgical pharmaceutical care to patients, presentation of a coherent patient care plan at Masters level and ability to critically appraise clinical data for efficacy and toxicity within the surgical setting. Assessment tools such as case based discussions and care plans addressed the needs of the module outcomes best mirroring workplace post graduate assessment tools. A hospital placement supervised by a surgical specialist pharmacist was undertaken to select appropriate patients. Students were required to attend 90% of the lectures exposing them to the multidisciplinary team and ensuring a holistic view of surgical patient management. The module ran at capacity but requests exceeded the 16

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student limit. The 13 pharmacy and 3 medical students passed the module satisfactorily achieving a minimum of an upper second degree score equivalent. All medical students received a first degree score equivalent for their case based discussion. Fifteen students (94%) completed the evaluation form. Common themes identified were appreciation of the breadth and depth of the module content and the value of the module for future practice. Case based discussions were considered an appropriate assessment tool.

Conclusion: The better performance by medical students could be due to their greater familiarity with case based discussions. Pharmacy students were new to this method of presenting to a team and debating patient cases. The use of this assessment tool needs to be further integrated into the pharmacy degree. The key results of the qualitative questionnaire were overwhelmingly positive. In view of the success of this module by student evaluation and pass rate it is recommended that the content of the module be rolled out to enable access to all final year students considering a career in hospital.

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6-159

Category: Preceptor Skills

Title: Optimisation of final year pharmacy clinical placements in an acute hospital teaching trust

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Purpose: A week hospital placement is a component of the final year pharmacy degree. Students have the opportunity to complete several tasks in pairs. One task is essential to complete, a patient pharmaceutical care plan. Students are supervised by hospital based practice supervisors(PS). During the placement students miss lectures and other university events. Previous evaluation identified although a valuable experience, students requested a more structured, organised placement, more patient interaction, increased support and feedback from PS, all tasks set should be completed and raised concerns of missing other degree components. Placements needed to be optimised with the resources available.

Methods: Placement objectives and previous student evaluation were reviewed jointly with the university and hospital to devise a joint programme and agreement of tasks. Meetings were held with university and hospital pharmacy senior teams to discuss previous evaluations and agree future placement content and logistics. PS meetings were arranged to review evaluation and identify support needed for the new placement structure including any training requirements. The placement induction was rewritten jointly by the university and hospital to meet both respective institution requirements. Clarification of students expectations of the placements was needed and this was done at their placement preparation session by both stakeholders. Two questionnaire based on the university module evaluation form were devised to evaluate firstly the student and secondly the PS experience of placements. Both questionnaires were piloted on respective sample groups and amendments made. PS were emailed their respective questionnaire after the first 4 weeks of placements. The students questionnaire was incorporated in their placement log book. This was completed and returned to the module leader one week after the placement. Student questionnaires from placements undertaken in the first 4 weeks were analysed and a qualitative review of the feedback by PS undertaken.

Results: Following discussions with the hospital and university it was agreed to reduce the placement duration 5 to 3 days enabling students to attend other University commitments and PS to fulfil their clinical commitments throughout the week. All tasks set were required to be completed. A revised department induction was introduced. PS requested more support on giving feedback and its documentation. On review of the log books post placements, all but one student had documented PS feedback. Questionnaires were received from 18 (100%) students and 8 (62%) PS. Student evaluation showed that the majority of students felt able to complete all the tasks, had adequate direction from their PS and found working in a hospital a positive

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experience. Student comments included: We were given plenty of time to complete the tasks and excellent feedback on completed tasks to identify where we were good and areas for improvement. PS felt that students were well prepared and more engaged in the placement compared to previous years. PS negative comments included that concern of the impact of the intensive supervision on routine work during the 3 day placement to support the students undertaking the increased number of tasks.

Conclusion: The joint collaboration was positively received by the university, PS and students. The structured induction supported the student experience and met both institutions requirements. All PS felt more aware of their role and responsibilities. The more structured placement demonstrated an improvement in engagement with the placement by students and PS however the challenges of setting students expectations prior to the placement must be addressed with reinforcement that the PS have a clinical role to deliver patient care alongside their student supervisory practice role. There is a constant challenge of delivering placements in a hospital setting and service delivery.

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6-160

Category: Preceptor Skills

Title: Elective residency preparation course may increase students ability to acquire PGY1 pharmacy residency

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Purpose: Pharmacy residency training has gained recognition as a vital necessity for graduates in a competitive job market. A residency preparation elective, offered to third-year pharmacy students, discussed residency opportunities, expectations, requirements and benefits of residency training. Additionally, students navigated the application process, created a professional curriculum vitae, underwent mock interviews, and learned how to identify programs to fit future goals. To enhance credentials, students also completed a research project and showcased their results at a local, state and/or national research forum. The purpose of this study was to determine if course participation enhanced student ability to obtain a PGY1 pharmacy residency.

Methods: An electronic cross-sectional survey was sent to all 2014 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 study.

Results: Sixty-seven students (94 percent) completed the survey. Twenty-five students indicated applying for a residency with 19 successfully acquiring a residency (17 through ASHP Residency Match Program), 1 through the Post-Match scramble, and 1 not utilizing the Match). Nine students took the residency readiness elective in the fall of 2012, 7 of which applied for a residency. 100 percent of students taking the residency preparation course were successful in obtaining a residency compared to 66 percent of students who did not take the course (RR 0.368, P equals 0.797). Additionally, students taking the residency preparation course had increased interview rates (71.6 percent vs 56.3 percent, P equals 0.235). Student comfort and familiarity with the ASHP residency application process also tended to favor students who had completed the residency preparation course.

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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, (significant differences in levels of preparation may not be evident for several years), response bias due to students enrolled in the course responding more favorably than those who were unable to enroll, and there may not be as many differences as this entire graduating class was generally regarded as a strong class by the faculty.

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Professional Poster Abstract

6-161

Category: Psychotherapy / Neurology

Title: Inpatient administration of long acting injectable antipsychotic agents effects on 30 day recidivism rates

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Purpose: Long acting injectable atypical antipsychotics (LAIA) are commonly used to treat psychiatric conditions such as schizophrenia in our institution. Relapse prevention is critical in treating the schizophrenic population as repeated relapses can worsen psychopathology and social functioning in those patients. The patient population served by our institution is low income and resource challenged with other co-morbidities. Non-adherence to oral treatment regimens may have contributed to treatment failure and relapse with subsequent readmission. Prior to June 2013, our institution used a combination of oral antipsychotic agents, immediate release injectable agents and relatively few doses of LAIA to treat our inpatient schizophrenic population. By July of 2013, our inpatient utilization of LAIA increased by 3 fold from the prior 12 month period in an attempt to improve compliance and decrease 30 day readmissions.

Methods: We conducted a retrospective chart review of inpatients at our institutions 37 bed psychiatric unit for the baseline period (July 2012-June 2013) and the post intervention period (July 2013-May 2014). Data documented included medication, medication form and preparation received, and history of hospital admissions. Thirty day readmission rates were provided for all patients admitted to the unit for both the baseline and post-intervention periods. The average occupancy rate of the unit during the baseline and post-intervention periods did not differ significantly

Results: The utilization rates of LAIA during the baseline period was 11 doses per month including 6.5 doses per month of risperidone twice monthly injection (RLAI) and 4.5 doses per month of paliperidone monthly injection (PPLAI). For the post intervention period, doses of these long acting injections increased to 37.6 doses per month including 2.6 doses per month of RLAI and 35 doses per month of PPLAI. Thirty day recidivism rates decreased by 15% comparing the post intervention period to the baseline period for patients receiving LAIA.

Conclusion: Increased utilization of paliperidone once monthly injection at our institution lowered our recidivism rates by 15%. We observed an 8 fold increase in use of the once monthly injection (paliperidone). Inpatient administration of once monthly LAIA to low-income, resource

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challenged, schizophrenic patients has the potential to decrease the rate of recidivism. Although our drug expenditure was offset by a manufacturer supported product replacement drug program and decreased 30 day readmission, independent analysis should be performed including these factors as well as the impact on patient outcomes

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6-162

Category: Psychotherapy / Neurology

Title: Antipsychotic poly pharmacy (APP) in treatment of schizophrenic resistant patients at a Lebanese psychiatric institution

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Purpose: According to the American Psychiatric Association (APA), adequate trials of multiple antipsychotics are often needed before antipsychotic treatment is optimized in patients with resistant symptoms. A trial of clozapine should be considered for a patient with a clinically inadequate response to antipsychotic treatment or for a patient with persistent psychotic symptoms. Various augmentation therapies with other antipsychotics that are limited or no evidence of supporting efficacy has been used. The purpose of this study is to evaluate the frequency and use of APP in schizophrenic resistant patients.

Methods: The Institutional review board approved this prospective observational study that included schizophrenic resistant patients and on one or more antipsychotics regimen. Data collection started from February 2014 till May 2014 included patients demographic information (sex, age, BMI, initial diagnosis, social history, and allergies), past medical history and present medical history for the antipsychotic medication, augmentation therapy, dose (including as required or p.r.n. antipsychotics), dosage forms and prescription date. The primary objectives of the study are to assess the number of patients on antipsychotic combinations including clozapine and to evaluate the use of poly pharmacy in schizophrenic elderly patients. The secondary objectives are to evaluate the use of APP including the dose, drug interactions and adverse events.

Results: Total of 200 patient charts were reviewed, only 116 patients were included. 95 patients (82%) were on combination including 49 patients on two, 26 patients on three and 20 patients on more than three antipsychotics. 44 different type of APP was identified and 29 patients were on clozapine either alone or in combination. Out of 11 patients who were elderly, 7 were on two antipsychotics and 1 patient was on combination of three antipsychotics. It was found that 4 elderly patients were receiving high dose of haloperidol either in combination or alone and 3 elderly patients were receiving clozapine in combination of two or three antipsychotics. During this observation period 100(86.2%) patients were responding on the medication used including the combination therapy. Out of 90 patients who developed adverse events on antipsychotics therapy, 74 patients were on combination. Events from APP were reported as cardiovascular (11), metabolic (11), anticholinergic (57), extrapyramidal symptoms (25), and blood abnormalities (9). 3 patients were detected to have a body mass index of more than 40 and

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receiving combination that contains either clozapine or risperidone and both are associated with frequent risk for side effect on weight gain , glucose level and lipid profile.

Conclusion: A common reason for poly pharmacy is to achieve a greater or more rapid therapeutic response than has been achieved with monotherapy. However, the evidence on the risks and benefits for such a strategy is not generally considered adequate to warrant a recommendation for its use in routine clinical practice in psychiatry. Large experimental studies must be conducted to evaluate and approve the best antipsychotic combination to be used .The role of pharmacist is crucial in optimizing and individualization of patient care in clinical practice at the Lebanese psychiatric institution.

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Professional Poster Abstract

6-163

Category: Quality Assurance / Medication Safety

Title: Implementation of MAK (electronic medication administration charting) in a geriatric psych population, challenges around standard times of administration and medication refusal

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Purpose: The benefits of electronic medication charting include legibility of notes, chart accessibility, standardized times of administration as well as improvements in medication safety. Implementation of MAK poses many challenges, including adherence to standard times of administration across a variety of patient populations and addressing medication refusal. The inpatient geriatric psych population is a unique patient population with extensive hospital stays where the patients often refuse meds or choose to self-dictate times of administration. This project was designed to uncover and address the challenges around standardizing times of administration and patient medication refusals in the geriatric psych population.

Methods: A pharmacy director with 13 years of experience in a small community hospital with a 40 bed geriatric psych unit was a member of the MAK implementation team. Building of the workflow took place over 2 years. The system wide team was comprised of pharmacy directors, informatics pharmacy specialist, hospital pharmacy information technology managers, nursing leadership and staff nurses. The team responsibilities were to plan and implement MAK, (using one platform) across 4 campuses ranging from small community hospitals to a large academic medical center collectively representing a wide variety of services and patient populations. Implementation of MAK at the community hospital was done over 1 day in all inpatient units, with 2 weeks of on-site support. The pharmacy director and the nursing informatics leader responsible for the geriatric psych unit identified local and global issues and addressed geriatric psych unit wide systems issues as well as geriatric patient specific matters related to standard times of administration and medication refusal both during and post MAK implementation.

Results: Many challenges to the implementation of MAK in the geriatric psych population were identified, including each patient being prescribed an average of 14 medications, patients removing wrist bands utilized for patient identification as well as bar-code scanning, patient refusal and/or agitation with the wrist band scanning process, patient refusal of medication at scheduled time of administration, necessity of nursing to make multiple approaches to individual patients for medication administration, often daily changes to medications prescribed and/or doses, medications not meeting standard times of administration resulting in non-standard work flow for nursing and safety risks associated with work stations on wheels in this patient population who are allowed to roam freely about the inpatient unit. Methods employed to

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address the challenges include creation of non-standard times of administration, additional nursing education related to non-standard times of administration, documented processes within the patient plan of care to reflect individual considerations and increased attention to electronic equipment necessary for MAK documentation.

Conclusion: Planning and implementing electronic medication administration charting is a complex task. It is critical that the right stakeholders are involved in building work flows and identifying standard times of administration. It is also essential that unique patient populations are considered and that systems do not prohibit patient specific tailoring of drug therapies if they are deemed necessary. Policies and procedures, algorithms, routine monitoring of workflow and process along with re-education need to be part of the implementation and ongoing utilization of MAK to ensure all disciplines can provide the optimal care and all patients receive the best care possible.

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6-165

Category: Quality Assurance / Medication Safety

Title: Comparison of pharmaceutical quality and product performance of albuterol inhalers available in the US and those obtained in Mexico for a fraction of US cost

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Purpose: American residents travel to Mexico to purchase medications, like albuterol inhalers, for 1/3 to 1/5 of the US price without prescription requirements. A previous bioequivalence study found clinical differences (P less than 0.05) between Ventolin and Assal, two Mexican manufactured albuterol inhaler brands. What other differences are there among such inhalers when we test more brands and analyze pharmaceutical qualities like respirable mass? This study seeks to provide some reasonable expectations for a medical tourist of Mexico who purchases albuterol metered dose inhalers (MDIs) by comparing the product performance of some of the brands available to the consumers in Mexico.

Methods: This study examined the performance of albuterol MDIs obtained from pharmacies in Nogales, Mexico. At least two units were purchased for each of the following brands: Xeneric-S, Victory, Ventolin (GlaxoSmithKline), Assal, and Sacrusyt. At least two lot numbers of each brand were included, with the exception of Sacrusyt, for which a second lot was unavailable at the purchase times. Sample MDIs were compared to US-purchased albuterol inhalers, Proventil and Ventolin. Total dose and respirable mass were determined for each MDI. These parameters were measured by actuating each inhaler into a USP throat, coupled to a cascade impactor, which separates drug particles based on aerodynamic particle size. Particles with an aerodynamic diameter larger than 4.7 micrometers are considered non-respirable, while particles less than 4.7 micrometers are considered respirable and the total of those particles is the respirable mass. The total dose delivered is determined by calculating the amount of drug that deposits onto the throat and the impactor. Quantification of albuterol was determined by high performance liquid chromatography (HPLC). In brief, the HPLC assay utilized an Apollo C18 column with a mobile phase of 1 percent phosphoric acid:methanol (77:23) at a flow rate of 0.75mL/min; UV detection was at 225 nm.

Results: Every inhaler was sold in a Spanish-labeled box containing a single page instruction insert and every inhaler label had a visible lot number, expiration date, and noted a 100 microgram dose. Listed manufacturing locations included China, Mexico, India, and Spain. All of the MDIs were purchased for about \$3 to \$5 each except for non-US Ventolin (\$10-\$20 each). The measurements of total dose and respirable mass among the five Mexican purchased brands

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of inhalers varied widely. The MDIs' average total doses ranged from 57 to 75 micrograms per actuation, while the average total dose of the US purchased MDIs was 79 to 82 micrograms. The respirable mass of the non-US MDIs was more similar. Among the study MDIs, respirable mass ranged from 28 to 41 micrograms, which compares to 38 to 42 micrograms for the two US branded albuterol inhalers. To further investigate the variability among the study MDIs, student t-tests were performed to compare the mean respirable mass for each brand to that of the other four brands. All comparisons were significantly different (p less than 0.05) except for two (Sacrusyt vs Assal, p equals 0.89; Xeneric vs Ventolin, p equals 0.98).

Conclusion: Since significant pharmaceutical variability was found among the albuterol MDIs evaluated in this study, clinicians and patients should be conscious of possible differences in quality, therapeutic efficacy, and safety for albuterol MDIs obtained in Mexico. Sample MDIs compared to each other were statistically different in total dose and respirable mass. Thus a patient who has used US MDIs before can't necessarily expect to get the same dose from non-US brands.

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Category: Quality Assurance / Medication Safety

Title: Novel approach to emergency department medication reconciliation in a rural hospital

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Purpose: With the advent of the electronic medical record and computerized provider order entry, accurate medication history documentation became more difficult and more time consuming for emergency department (ED) nurses who historically obtained these histories during the admission process. A drop in quality of medication histories made electronic medication order conversion less accurate, causing a slowing of both the admission and discharge process and leading to high provider frustration levels. Believing an alternative approach was needed, we developed a novel pharmacy-based initiative using certified pharmacy technicians to provide more timely and accurate medication histories as well as enhanced allergy information.

Methods: Approval was granted to fund one full time equivalent (FTE) pharmacy technician for a pilot program in the ED. Standardized interview processes and competency training for technicians were developed by two clinical pharmacists. Technicians prioritize patients, and then interview each patient to obtain medication histories and allergy information. Additional information is obtained by phone calls to pharmacies and physician offices. Information is organized and written on a standardized form and attached to any other pertinent data used in the history process. Information is then entered into the electronic medical record by the technician. The paper form and other information are sent to be double-checked against the electronic record by a pharmacist who records total number of errors found. Staff pharmacists were trained for the final verification process due to the lack of an ED pharmacist. Data was collected using a standardized form with spaces for total number of phone calls, allergy clarifications, medications, and follow-up. The clinical pharmacists also retrospectively reviewed medication histories obtained by nurses, and evaluated them for errors by checking for completeness and proper entry into the electronic medical record. This data was compared to the data compiled from the technicians to analyze error rates.

Results: The mean nursing error rate prior to implementation of our program was 0.21 (CI 0.193-0.227). This was calculated by retrospectively analyzing 7822 medications and citing a maximum of 1 error per medication documented. The criterion for an error was limited to information available which included: invalid format, invalid doses or frequencies and, most commonly, partial or incomplete information. The technician mean error rate was 0.018 (CI 0.0148-0.0182). This was calculated by analyzing 124,914 medications with a maximum of 1 error per medication documented. With the prospective nature of the data, errors were able to be analyzed much more comprehensively. In addition to nursing criterion, pharmacists were able to

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identify other types of errors including improper transcription of medication and compliance information. Even with the additional level of scrutiny, the results showed a statistically superior advantage for pharmacy technician versus nursing documentation ($P < 0.05$). In addition, technicians documented 4645 allergy clarifications and made 2913 phone calls to facilitate data acquisition. Based upon this data and positive feedback from provider and nursing staff, support from the executive team allowed the initial pilot program to expand to 1.75 FTEs to provide daily coverage in the ED.

Conclusion: Properly trained certified pharmacy technicians have demonstrated statistically superior accuracy in obtaining medication histories compared to those obtained by nurses. Additionally, increased nursing and provider satisfaction, as well as a positive impact on the admission and discharge processes were noted. This rural community hospital's unique process model has proven to work successfully and could be used by other institutions seeking to implement a technician-based solution to obtaining accurate medication histories.

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Category: Quality Assurance / Medication Safety

Title: Intestinal obstruction associated with calcium polystyrene sulfonate (Kalimate) in an intestinal transplant recipient: a case report

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Case Report

Purpose: Sodium and calcium polystyrene sulfonate are agents commonly used for the treatment of hyperkalemia. There is published reports of severe gastrointestinal complication, such as acute obstruction and mucosal necrosis, after the administration of these agents. In this case report, we present a case of intestinal obstruction associated with calcium polystyrene sulfonate (CPS) in an intestinal transplant patient to remind health professionals of this rare but potentially fatal adverse effect. A 66-year-old male patient, who underwent intestinal transplantation in June 25, 2013, was prescribed CPS 5 grams every 8 hours for the management of intermittent hyperkalemia as an inpatient in August 2013. The dose of CPS was adjusted several times according to his serum potassium level, and was at a dose of 5 grams twice a day in September 2013. Because of his persistent hyperkalemia, CPS was continued until November 2013. Cortisone acetate 50 mg was given once in the morning and 25 mg once at night for suspected adrenal insufficiency due to both hyponatremia and hyperkalemia was noted, but only slight improvement was seen. On November 14, cortisone acetate was shifted to fludrocortisone 100 mcg once daily and CPS was discontinued and his serum potassium and sodium level both dropped within normal range. He was re-admitted into our hospital complaining of vomiting and uncomfortable but not painful feeling in the abdomen on November 17. Supine kidney-ureter-bladder x-ray showed that there were dilated bowel loops in upper abdomen, possibly in the small intestine. Bedside abdominal sonography showed much content in the stomach, dilated small intestine in the upper abdomen with fluid-like content and collapsed colon. Abdominal imaging showed the ascending colon is relatively small in caliber, and descending colon had collapsed but the left psoas shadow was still clear. These results indicate partial intestinal obstruction associated with CPS. He was initially treated with supportive care but little improvement was seen. Several methods were used but there was difficulty in resolving this intestinal obstruction. Rectal tube was inserted into the patients ileostomy but nothing was drained out. Soap solution enema was given through the ileostomy twice with only little pieces of light yellow round material flushed out. Gastrografin 10 ml once a day was given for five doses to improve intestinal peristalsis and normal saline enema given through ileostomy but the obstruction persisted. Phosphate-based enema was given through his ileostomy on December 6 and a little hard stool came out from the ileostomy, but abdominal sonography continued to show

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intestinal ileus and precipitates in his small intestine. Operation was arranged on December 13, and the obstruction was eventually resolved with 4 liters of normal saline irrigation. This case report highlights the potential for gastrointestinal obstruction associated with the administration of CPS. For this patient, poor intestinal peristalsis may be a contributing factor in the pathogenesis of intestinal obstruction. Health professionals should exercise caution when CPS is administered to individuals who are at high risk of this serious complication and consider the use of alternative agents, such as insulin and fludrocortisone which has been reported effectively managing hyperkalemia in liver transplant recipients, for the management of hyperkalemia.

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Category: Quality Assurance / Medication Safety

Title: Pharmacy technician-driven medication reconciliation in the emergency department

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Purpose: Accurate and complete medication reconciliation is vital for patient safety. Medication reconciliation tends to be inaccurate and incomplete for various reasons including missing or misinformation provided by the patient or their caregiver, and limited time devoted to the medication reconciliation process by medical providers. Studies have demonstrated that inclusion of a pharmacist into the medication reconciliation process results in more complete medication histories. A pharmacy technician-driven medication reconciliation project was designed to provide accurate, reconciled medication lists prior to admission with the goals of optimizing pharmacotherapy, decreasing medication errors, and increasing patient safety while providing a more cost-effective strategy.

Methods: A ten-week pharmacy technician-driven medication reconciliation project was conducted in the emergency department of a level one trauma center at Community Regional Medical Center. A dedicated pharmacy technician was trained to obtain medication histories through a variety of complementary methodologies, such as patient and family interviews, collaboration with outpatient pharmacies and physicians offices, as well as querying third party payer data. The technician was responsible for medication reconciliation prior to admission from the emergency department. The technician was trained, supervised, and audited by a pharmacist throughout the project. The pharmacist also served as a resource when complex medication regimens were identified and required clarification. For patients that had a pharmacy technician-driven medication reconciliation record, the percentage of complete medication reconciliation was compared to the nursing-derived medication list. The time to completion of each medication reconciliation list was also monitored. Discrepancies were assessed for potential to cause patient harm if unresolved, using the National Coordinating Council for Medication Error Reporting and Prevention index as a guide. Cost avoidance associated with averted medication errors secondary to pharmacy technician-assisted medication reconciliation was also assessed.

Results: A pharmacy technician performed medication reconciliation on 363 patients. The average number of medications per patient was 9.9, and the average number of medications per patient with at least one error was 5.6. When compared to the technician-derived medication reconciliation lists, 325 patients (89.5%) had incomplete nursing-derived medication reconciliation lists. The average number of minutes to perform medication reconciliation per patient by a pharmacy technician was 32 minutes. Approximately 50% of the medication discrepancies were deemed as adverse drug events that would have added cost to the patients

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length of stay if left unresolved, and fell in category D or higher on the National Coordinating Council for Medication Error Reporting and Prevention index guide. The estimated cost-avoidance per patient associated with medication reconciliation was \$13,118.

Conclusion: The pharmacy technician-driven medication reconciliation project undertaken at Community Regional Medical Center provided more accurate and complete medication reconciliation lists compared to the nursing-derived lists. We demonstrated, as previous studies have done, the benefit of including a pharmacy professional in the medication reconciliation process. Accurate and complete medication reconciliation allows for optimization of pharmacotherapy, and results in decreased medication errors, and increased patient safety. This project was cost-effective in that it provided a substantial cost-avoidance per patient, and used a dedicated licensed pharmacy technician instead of a pharmacist to perform the medication reconciliation process.

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Category: Quality Assurance / Medication Safety

Title: Medication management: are we managing medications well to prevent

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Purpose: Many studies had showed the concomitant use of statins and amiodarone and /or gemfibrozil was associated with increased risks of rhabdomyolysis. Therefore, Kaiser Southern California deployed a number of statin interaction alerts into the EMR system in 2010 and initiated a regional pharmacist-led safety net program to intervene on the patients taking an interacting statin with amiodarone. Similarly, in 2012, safety net was expanded to include interacting statin with gemfibrozil. This study was conducted to evaluate the effectiveness of the EMR statin-interaction alert system as well as the effectiveness of the regional safety net led by a clinical pharmacist for preventing rhabdomyolysis events related to the use of statin with amiodarone and/or gemfibrozil.

Methods: A retrospective, observational study was performed by data analysis of approximately over 18,000 patients taking an interacting statin with amiodarone and/or gemfibrozil in Kaiser Southern California during Jan 2006 to Dec 2013.

Results: The rhabdomyolysis cases decreased over time as did the number of patients on an interacting combination. The event rate ranged from 0.29% to 0.15% per year. In addition, the percentage of ignored alerts for statins prescribed with a gemfibrozil decreased (85% to 65%) over time but remained the same for amiodarone (81%).

Conclusion: The regional pharmacist-led safety net was able to successfully reduce the number of patient on interacting statins with amiodarone and/or gemfibrozil and potentially reduce the risk of rhabdomyolysis when alerts failed to change the physicians decision. Therefore, it is important to put in place other systems to catch a safety issue when an EMR alert is ignored as healthcare organizations continue to implement alerts for patient safety.

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Category: Quality Assurance / Medication Safety

Title: Reduction in clinically relevant medication errors by use of prior to admission medication technicians (PtAMT)

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Purpose: The Joint Commissions National Patient Safety Goal (NPSG) 03.06.01 EP 1 requires that all inpatient institutions obtain an effective medication list from all acute care patients. Due to the increasing demands on the front-line nurse beyond direct patient care (e.g., CMS Core Measure documentation, HCAHPS compliance documentation, etc), the ability to effectively generate a complete and accurate prior to admission (PTA) medication list for all patients is often compromised. The purpose of this study was to analyze the accuracy of PTA medication histories obtained by advanced pharmacy practice experience (APPE) students and certified pharmacy technicians versus registered nurses.

Methods: A senior pharmacy student received a list of patients admitted the previous day (inpatient and observation) Monday through Friday during the study period. If professional assistance was required a staff pharmacist was involved in the review. Data was collected electronically to quantify the medication error rate differences, types of medication errors, and the required time to obtain the most accurate home medication list when completed by an APPE student. Post pilot data was collected on medication histories being obtained by PtAMT to further validate the pilot data.

Results: Of the 22 PTA medication histories completed during the pilot, there were 26 medication omission errors, 20 medication inclusion errors, and 45 errors related to incorrect medication, incorrect dose, or incorrect frequency. Only 2 PTA medication histories collected did not require some form of corrective action. Total medication errors were 91 per 22 PTA medication histories collected resulting in a 4.13 error factor. Post pilot data revealed 0.66 incorrect medication or dose per patient case reviewed as compared to 0.73 per patient case reviewed during the pilot period. There were 1.18 and 0.91 medication omissions per patient case reviewed for pilot and pilot validation, respectively.

Conclusion: Accurate and complete PTA medication lists are essential for proper patient care. We have demonstrated APPE students and PtAMT generate a clinically useful prior to admission medication list within our institution. Results were similar to those of comparable regional facilities providing medication reconciliation services.

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Category: Quality Assurance / Medication Safety

Title: Evaluation of a pilot study at mount carmel health system: discharge medication reconciliation and counseling initiative

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Purpose: Transition of care is a major risk point for patients in today's health care environment. Up to 60% of patients experience at least one unintended medication variance at admission or discharge, which puts patient safety at risk. The Joint Commission requires accredited facilities to accurately and completely reconcile medications across the continuum of care and it was acknowledged that our hospital could improve the discharge process. Our goal, as pharmacists, was to work with a multidisciplinary team to improve patient safety, reduce medication errors, increase patient satisfaction, and reduce hospital readmissions through a discharge medication reconciliation and counseling initiative.

Methods: This study is an ongoing initiative; a prospective study conducted from June 2013 to June 2014 on a medical intermediate care unit at Mount Carmel West Hospital, Columbus OH. The study was approved by the institutional review board (IRB) prior to initiation. Data elements collected include interventions such as disease state management, dose change, drug interaction, etc. Interventions are further classified according to modified categories, based on NCC MERP, assessing the capacity of harm to patient had the intervention not been made. Patient satisfaction scores are also collected to assess whether patients clearly understood the purpose of the medications at discharge via the Press-Ganey survey. Pharmacists identify which patients will be discharged daily, screen for eligibility into our discharge initiative, and prioritization of counseling. The Pharmacists ensure the plan for discharge medications is accurately reflected in the discharge medication reconciliation and the most appropriate and affordable medications were prescribed. Patient education materials are printed for all new medications and a simplified purpose is added to all medications listed. Three to seven days post discharge the pharmacist calls the patient to ensure new medications were started, answer questions regarding medications, and identify potential side effects.

Results: The initiation of our pilot has greatly impacted the patient safety and quality of care for the medical intermediate care unit. During the initial twenty weeks the pharmacists were able to review, counsel, and follow up with 431 patients. By the end of June 2014 we hope to see well over 1000 patients. Preliminary results for 20 weeks of the 52 weeks shows 33% of all patients seen by our pharmacists have had an intervention made. 144 patients required a pharmacist

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intervention and 213 interventions were made. 75 of those interventions had the potential for serious capacity for harm or were potentially life threatening. Medication errors with serious harm cost on average \$2,200. Over the twenty week timeframe 75 interventions were made to avoid serious capacity for harm errors resulting in \$165,000 in cost avoidance (75 errors x \$2,200/serious error = \$165,000). After adding in the cost of 1.5 FTE pharmacist for the twenty week timeframe (\$54,000) the net savings totaled \$111,000 for twenty weeks on one medical intermediate care unit. Patient satisfaction has also shown a positive trend with patients strongly agreeing that when they left the hospital they clearly understood the purpose for taking each of their medications.

Conclusion: Through the collaboration of pharmacy, nursing, physicians and case managers, patients are getting a consistent and focused review and counseling session about proper medication management at discharge. Data continues to be collected to evaluate the effectiveness of this initiative on readmission rates. Overall this initiative has been received extremely well by the multidisciplinary team leading to better care for our patients. By expanding the role of inpatient pharmacists we are bridging the patients through error-prone transitions of care and bringing the medication expert to the bedside to ensure fewer medication errors and improve patient satisfaction and safety.

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Category: Quality Assurance / Medication Safety

Title: Risk factors and prescribing trends identified in patients requiring naloxone in a community hospital

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Purpose: Although opiates are relatively safe and effective, improper prescribing and inadequate monitoring have resulted in severe adverse drug events (ADEs). Respiratory depression is the most serious ADE related to opioid use, often requiring naloxone to reverse its effects. Risk factors known to be associated with opioid-induced respiratory depression include higher opioid doses, co-administration of other CNS depressants, sleep apnea, obesity, pre-existing pulmonary or cardiac disease, and advanced age. The purpose of this study was to review naloxone use and identify risk factors to determine potential strategies to reduce the risk of opioid-related ADEs.

Methods: This was a descriptive, IRB-approved, concurrent chart review of all patients ≥ 18 years of age who received at least one dose of naloxone for hospital acquired opioid toxicity from September 1st, 2013 to February 28th, 2014. Patients were excluded if they received naloxone for community acquired opioid toxicity or for anesthesia arousal in the post anesthesia care unit (PACU). Data collected included demographics; comorbidities; opioid tolerance status (naïve vs. experienced); inpatient opioids administered in the previous 24 hours prior to naloxone use including name, dose, frequency, route and concomitant CNS depressant use (e.g., benzodiazepines, muscle relaxants, anticholinergics, etc). The most common opiate agents and dose (in oral morphine equivalents), as well as the most frequent risk factors associated with naloxone use were identified using descriptive statistics.

Results: Out of 76 patients who received at least one dose of naloxone during the study period, 33 (43%) were included in the study. Thirty three patients received 59 opioid medication orders, out of which 24 (41%) were hydromorphone, 16 (27%) were fentanyl and 11 (19%) were morphine orders. The average number of opioid orders received in 24 hours prior to naloxone use was 1.8 opioids per patient. The median amount of opioid received prior to requiring naloxone was 78 mg expressed in oral morphine equivalents. Thirty one patients (94%) were identified as opioid naïve, 26 (79%) had a pre-existing cardiac condition, 24 (73%) were over the age of 60 years, and 23 (70%) were concomitantly receiving a CNS depressant. Obesity, post-surgery, and pre-existing pulmonary disease were observed in 17 (52%) patients. Sixteen (48%) patients had 7 or more risk factors for opioid respiratory depression, while 14 (42%) had between 4 and 6 risk factors.

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Conclusion: The most prevalent agents requiring naloxone administration for reversal of opioid-induced toxicities were hydromorphone, fentanyl, and morphine. In general, these patients received more than one opioid in the previous 24 hours prior to naloxone use. The most common risk factors for respiratory depression identified were opioid naivety, advanced age, pre-existing cardiac conditions, and concomitant use of CNS depressants. Patients requiring naloxone use had multiple risk factors for opioid-related ADEs.

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Category: Quality Assurance / Medication Safety

Title: Public Awareness towards counterfeit medicine in Lebanon

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Purpose: The objective of this study was to determine public awareness towards counterfeit medicine (CFM) in Lebanon.

Methods: A public awareness survey was developed to assess public familiarity with the term CFM, ability to identify and differentiate between counterfeit medicine and authentic medicines, and opinion on the importance of patient education to avoid use of counterfeit medicine. The survey included participants who were above 18 years old and willing to participate. The survey was administered at different regions in Lebanon and participation was on a voluntary basis. The School Research Committee approved the study.

Results: The Public awareness survey had 464 participants, around 94% of them heard of the term CFM, however, when asked to compare CFM to authentic, almost 49% did not know or did not answer. Furthermore, 30% thought authentic medicine was more effective, yet, when asked how they can differentiate between the two, 42% looked for the hologram and around 29% did not know how. However, 83% of participants thought the best way to avoid getting CFM, was to get them from a trust worthy pharmacist. In addition, TV was the source of awareness for 84% of participants.

Conclusion: This study demonstrated the need to have more educational campaigns addressing the risks and consequences of CFM in order to stop their use. The government and regulatory authorities should apply and enforce the newly implemented law in order to halt counterfeiters, their collaborators and accomplices. The trust relationship between patients and pharmacists primarily, and other healthcare professionals, manufacturers, professional organizations, governmental and regulatory authorities should be valued and emphasized in all actions related to the public.

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Category: Quality Assurance / Medication Safety

Title: Implementation of a pharmacy QA dashboard

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Purpose: The Pharmacy Department creates an annual operating plan (AOP). The pharmacy administrative team lacked a process whereby to visualize performance measures of the AOP over time. The Business Transformation Office worked with the pharmacy administration team to design and implement a sustainable Quality Assurance (QA) dashboard. The scope was to categorize key measures of the pharmacy's AOP under the BIDMC AOP classifications: Quality, People, Cost, and Systems and then to track quantifiable performance measures on a monthly basis.

Methods: The goal was to create an initial Pharmacy QA dashboard, gradually populate it with performance measures which link directly to the Pharmacy AOP and develop 3 or 4 performance measures by the end of FY13. Currently, each pharmacy supervisor and clinical coordinator is adding 1 performance measure to the QA dashboard. The goal is to maintain and update the dashboard annually.

Results: The following performance measures are tracked on a monthly basis: absence of barcodes on eMAR (Systems), scanning failures in eMAR (Systems), pharmacist competency exam completion rates (People), Research Pharmacy workload statistics of IV and oral dispensations and meetings, including audits and site initiation visits (Systems), and Policy and Procedure review and completion (Quality).

Conclusion: There is utility in implementing a pharmacy QA dashboard. Keys to success include maintaining and updating (monthly) all current measures, adding new measures (ideally one from each member of the pharmacy administrative team), and updating the dashboard annually based on the new Pharmacy AOP. The visual data has been helpful to assess and track progress over time. Grasping the concept and benefits of a Pharmacy QA dashboard takes time. Its success seems to rely on having one or two dedicated people to oversee and manage the dashboard and remind people to update progress on a monthly basis as well as making dedicated time to handle and review the dashboard.

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Category: Quality Assurance / Medication Safety

Title: Incidence and system management for fosaprepitant related infusion reactions at Memorial Sloan Kettering Cancer Center (MSKCC)

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Purpose: At MSKCC, all patients receiving chemotherapy with high emetic risk receive palonosetron, fosaprepitant and dexamethasone. In June 2013, our institution switched from aprepitant to fosaprepitant. Administration of fosaprepitant is given during same visit as chemotherapy, requires no pharmacy co-pay, and requires no doses post chemotherapy. In two large clinical trials no serious ADRs and less than 3% infusion site reactions were reported in over 1,200 patients. During our transition, numerous reports of severe reactions were reported to our Pharmacy & Therapeutics committee. This abstract reports our institutions experience with infusion reactions and changes which were made to manage this issue.

Methods: All adverse drug reaction (ADR) reports related to fosaprepitant between June and December 2013 were analyzed for severe infusion reactions and concurrent therapies. PubMed was searched for recent studies and case reports pertaining to hypersensitivity reactions with fosaprepitant (or aprepitant). Data found in the literature were supplemented with documentation obtained from the pharmaceutical manufacturer Merck.

Results: Severe hypersensitivity reactions are rare in clinical trials and case reports in literature, compared to 0.5% of aprepitant. During the 6month period at MSKCC following the transition to IV fosaprepitant, 7 patients suffered systemic infusion related reactions, 4 requiring rescue medication and/or oxygen. The causative agent for these reactions is likely not the fosaprepitant but polysorbate 80, an amphipathic nonionic surfactant, required for stability. Numerous reports in Literature have reported immediate-type hypersensitivity & intolerance reactions to poly-80. In addition to fosaprepitant, Poly-80 is commonly used in other medical products such as: medical products including: creams, emulsions, IV, solutions, and syrups. To prevent further reactions with these patients, our EMR was set up with a soft stop and numerous additional allergy flags for this agent and known chemotherapy medication formulated with Poly-80. Pharmacist driven intervention and system wide adjustment was implemented to avoid future administration of poly-80 containing medication to patients who had reacted to fosaprepitant. Our EMR was adjusted to add a fosaprepitant allergy code to all patients with known poly-80 allergy.

Conclusion: Pharmacist now notify prescribing physician and automatically enter order for aprepitant PO. The allergy coding is separate for aprepitant, to allow for ordering and dispensing of this agent in patients who have known fosaprepitant allergies. Patients with history of reaction to polysorbate 80 containing agent would receive an allergy warning when fosaprepitant is prescribed. In addition, the alert flag was tied to all other medication known to be formulated

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with poly-80 and an alert will pop if these are ordered or vice-versa if patient has allergy to either medication.

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Category: Quality Assurance / Medication Safety

Title: Improving patient safety with a prospective study of a pharmacy-based medication reconciliation program

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Purpose: Inaccurate medication reconciliation (MR) is the source for 27 percent of all hospital medication errors; thus MR accuracy is the third goal of the Joint Commissions 2014 National Patient Safety Goals. The Buckley et al. study revealed 97 percent of medication histories contained at least one discrepancy when conducted by non-pharmacy health care personnel. Therefore, the purpose of this study is to identify and categorize medication errors resulting from MR conducted by non-pharmacy health care personnel. The study further evaluates the MR discrepancies resulting among various ethnicities, living situations, and hospital units.

Methods: This prospective observational study was conducted within the period of February 11th to April 1st, 2014 at a community-based teaching hospital. Two pharmacy student investigators conducted secondary MR after nurses and physicians completed the initial MR. The study included only high-risk patients from the following hospital units: Behavioral Health Unit (BHU), Intensive Care Unit (ICU), and Medical Surgical Unit (MSU). The high-risk patients were defined as patients at least 65 years old with less than three comorbidities, in addition to low health literacy (non-English speakers or dementia). Patients were also considered high-risk regardless of age or health literacy status if they had at least three comorbidities. The pharmacy students obtained medication histories for the study population by contacting dispensing pharmacies, skilled nursing facilities (SNFs), dialysis centers, hospitals from prior admissions, and pharmacy insurance companies to cross-reference the initial MR. The identified discrepancies were categorized and addressed to a licensed pharmacist to carry out the appropriate interventions. The T-test and Confidence Function were used to analyze the confidence interval and statistical difference of the study results.

Results: Medication errors were identified in 95 percent of the study population, averaging 6.6 discrepancies per patient. The errors were categorized as follows: 45 percent omissions, 28 percent inactive or wrong medications, 10 percent frequency discrepancies, 9 percent dose or strength discrepancies, 5 percent duplication discrepancies, and 3 percent route discrepancies. The average error rates per patient among the hospital units were: ICU 7.14 (95 percent CI, 4.82-9.46), MSU 6.69 (95 percent CI, 5.86-7.52), and BHU 5.92 (95 percent CI, 4.53-7.31). The average error rates per patient for the various living situations were: homeless 3.60 (95 percent CI, 2.22-4.98), home admits 5.74 (95 percent CI, 4.68-6.80), assisted living facilities 6.69 (95 percent CI, 4.11-9.26), and SNF 8.25 (95 percent CI, 6.90-9.60). SNF patients had higher error

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rates than those from home (p equals 0.004) or homeless (p equals 0.007). In terms of ethnicity the average error rates per patient were: African Americans 6.18 (95 percent CI, 4.69-7.66), Caucasians 6.65 (95 percent CI, 5.41-7.88), Hispanics 6.63 (95 percent CI, 5.03-8.22), Asian 7.38 (95 percent CI, 2.33-10.16), and the Other minority group 8.00 (95 percent CI, 5.01-10.99).

Conclusion: Medication discrepancies were identified in nearly every initial MR completed by physicians and nurses. The results further revealed SNF patients had the most MR discrepancies, which was unanticipated because SNFs provide medication administration records upon the transition of care. The supervising pharmacists intervened on these medication errors and in many cases before it reached the patient. Thus, the results from this study reinforce the necessity for pharmacy-based MR in high-risk patients to ensure the acquisition of accurate medication histories and prevention of medication errors.

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6-177

Category: Quality Assurance / Medication Safety

Title: Development of gastrointestinal necrosis after the administration of calcium polystyrene sulfonate: two cases report

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Case Report

Purpose: The American Journal of Medicine released a safety alert recently on the association of fatal gastrointestinal (GI) adverse events with the use of sodium polystyrene sulfonate (SPS) combined with sorbitol. Calcium polystyrene sulfonate (CPS), which works via the similar pharmacologic mechanism of action as SPS, is a cation exchange resin used for the management of hyperkalemia induced by acute or chronic renal failure. At a medical center in Taiwan, GI adverse events similar to SPS were also reported with CPS. We identified two suspected cases who were treated with CPS and developed gastrointestinal necrosis. The first case is an 88-year-old woman with a history of hypertension and arthritis of the knees. She came to our emergency department in July 2013 due to dyspnea. Her blood chemical analysis showed hyperkalemia (potassium level=7.2 mmol/L), acute kidney injury (sodium level=128 mmol/L, serum creatinine =3.51 mg/dL) and anemia (hemoglobin=5.2 g/dL). She was prescribed CPS for the management of hyperkalemia in combination with a low potassium diet. CPS was given 20 g every 6 hours on the first day of hospital admission and dose reduced to 10 g every 6 hours on the following day. Sennoside 24 mg was prescribed for constipation. On the third day of hospital admission, diarrhea with blood tinged stool was noted. Gastroscopy and colonoscopy revealed gastric, colon and rectal ulceration. CPS was discontinued and the potassium level was 4.5 mmol/L. This patient was discharged after 13 days of hospitalization with supportive care and was further followed up at our out-patient clinic. The second case is an 83-year-old woman with a history of hypertension, diabetes insipidus and colon cancer. She admitted to our hospital on Oct. 21, 2013 under the impression of consciousness disturbance and shortness of breath. Her electrocardiogram showed atrial fibrillation, and blood chemical analysis revealed blood potassium level of 6.2 mmol/L, serum creatinine of 1.73 mg/dL, blood sugar of 556 mg/dL and pyuria. She was immediately prescribed CPS 10 g every 6 hours for the management of hyperkalemia. On the following day, she had coffee ground aspirate in nasogastric tube and blood in stools. The colonoscopy revealed a hemorrhagic ulcer at the descending colon. The symptoms were resolved on the tenth day of hospitalization. The two cases demonstrated above showed that patients developed GI necrosis developed 4 days and 1 day after using CPS for the management of hyperkalemia. No specific management is required and it was resolved approximately 7 days after discontinuing CPS and with supportive care. Review of current published literature showed that CPS or SPS associated GI adverse events are more likely to

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occur in elderly patients with GI conditions, female, chronic renal impairment which corresponded with our patients. Although further study is required to confirm the pathogenesis and risk factors for CPS-related GI adverse effects, it is imperative that pharmacists and other health care providers should take extra precaution in patients with potential risk factors who are more likely to be predisposed to this adverse effect.

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6-178

Category: Quality Assurance / Medication Safety

Title: Evaluation of intravenous acetaminophen preparation and delivery in a pediatric hospital

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Purpose: Acetaminophen may be administered intravenously (IV) when oral or rectal administration is not appropriate in pediatric patients. IV acetaminophen manufacturer product information recommends using vial contents within six hours of opening. Stability testing of the 10mg/mL concentration has shown that IV acetaminophen is stable beyond six hours. Delivery expectations for STAT medications is 15 minutes and 60 minutes for routine medications. Due to manufacturer product stability information and expectation of STAT medication turn-around time, the objective of this study was to evaluate the need for batch preparation of IV acetaminophen doses with dating beyond six hours.

Methods: Using electronic dispensing and delivery tracking records, for IV acetaminophen the number of doses, corresponding strengths dispensed, and amount of time from medication request to delivery of medication to the patient unit was collected and analyzed for the month of April 2014.

Results: 1,231 IV acetaminophen doses were dispensed. 626 (50%) doses for standing around-the-clock acetaminophen orders and 615 (50%) doses as needed (PRN) acetaminophen orders. The top ten dose strengths filled included 30 mg (2%), 60 mg (5%), 100 mg (2%), 120 mg (13%), 160 mg (7%), 200 mg (4%), 240 mg (10%), 325 mg (6%), 500 mg (14%), and 650 mg (36%). Medication request turn-around time data were categorized into four ranges: <15 minutes (5%), 15 - <30 minutes (26%), 30 - <60 minutes (48%), >60 minutes (21%).

Conclusion: Length of time required for preparation and delivery does not consistently meet expectations for routine and STAT medications and should be improved. The utility of batch production of IV acetaminophen with extended beyond use dating is warranted and will likely decrease the need for preparation of urgent doses and improve medication turn-around since pre-drawn syringes will be readily available for dispensing.

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6-179

Category: Quality Assurance / Medication Safety

Title: Improving patient controlled analgesia (PCA) safety in a multi-hospital system using computerized provider order entry (CPOE) and smart pump technology

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Purpose: We improved PCA safety across a 33 hospital system, by integrating CPOE entries, smart pump libraries, and patient monitoring practices.

Methods: Work began in June 2010 to improve PCA safety across all adult care settings. We wished to expand use of capnography and ensure access to naloxone as a rescue agent. Prior to August 2012, no hard limits for maximum dose were programmed into the pump software, since all patients, regardless of opiate history, were treated with the same rule set. A soft limit for high dose was used, and was generously set to avoid nuisance alarms. An 80 member multidisciplinary team met at least 40 times to develop comprehensive safety strategies integrating CPOE and smart pump technology. The single rule set was replaced by rules for four different groups of patients based on previous opiate history (opiate nave, low, moderate, high tolerance). Maximum doses, using a hard stop were developed for all levels except high tolerance. Tools were developed to help classify patients appropriately based on opiate history. We monitored alert data from the infusion devices in an effort to further assess improvements. A good catch has a standard definition within the safety software, and it can be assumed that good catches prevent medication errors from reaching patients.

Results: We assessed the number of good catches in February of 2012, 2013 and 2014. A good catch is defined as detection of a specific type of entry error: no decimal, double digit, zero missing, rate/dose mismatch or dose too high. Patients received fentanyl, morphine or hydromorphone in settings of care that included critical care, medical/surgical floors, labor/delivery or oncology. The number of good catches in February 2012 was 69. In February 2013, 180 good catches were detected. Eighty one of 180 were due to the presence of a hard stop in the software, which was not present prior to the completion of the project. PCA use decreased by 19.6% over the two time periods. Nearly 5000 alerts were related to the use of the high tolerance rules to infuse fentanyl in ventilated ICU patients. A separate ICU sedation entry was implemented with rules that allowed high doses, but was located on a separate page of the pump programming screen. ICU nurses found it difficult to locate the entry, and in a second cycle of improvement, we adjusted the alphabetical presentation of the entries. Further decreases in alerts for this entry were observed after decreasing the low dose limit to allow weaning.

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Conclusion: Our project anticipated the August 2012 TJC recommendations related to opioid safety in hospitals and established policies, EHR order sets, monitoring tools, and smart pump settings that support best practices. Unintended consequences related to fentanyl dosing alerts occurred in ICU patients. Continuous monitoring allows continuous adjustment of the smart pump libraries.

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6-180

Category: Quality Assurance / Medication Safety

Title: Characterization of inpatients transitioned between rivaroxaban and heparin infusions at UAB Hospital

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Purpose: UAB Hospital recently switched heparin infusion monitoring to anti-Xa assay from activated partial thromboplastin time (aPTT). Rivaroxaban is a selective factor Xa inhibitor and affects the anti-Xa assay although the anti-Xa cannot be correlated with the degree of anticoagulation. It is unknown if rivaroxaban is affecting coagulation monitoring of patients transitioned from rivaroxaban to a heparin infusion. The purpose of this study is to evaluate the effect of rivaroxaban on anti-Xa assay monitoring of inpatients switched from rivaroxaban to a heparin infusion. Results will be compared to a similar group of inpatients not taking rivaroxaban and started on a heparin infusion.

Methods: The UAB Investigational Review Board approved this retrospective study. Patients admitted to UAB hospital from April 1, 2013 to December 31, 2013, who received rivaroxaban at home or in the hospital and were then transitioned to a heparin infusion were identified and included in the retrospective review. A similar comparator group of patients admitted from April 1, 2013 to December 31, 2013 who did not receive prior rivaroxaban and were started on a heparin infusion in the hospital were also identified. The primary outcome of this study was to compare the first anti-Xa levels between the two study groups. Secondary outcomes included comparing the time to first therapeutic anti-Xa, defined as a level between 0.3-0.7 units/mL, adverse events due to anticoagulation, the need for blood transfusions during hospital stay, and the use of anticoagulation reversal agents between the two study groups.

Results: Eleven patients were identified in each group. Each group had similar patient demographics. The median first anti-Xa level for the rivaroxaban group was 0.5 units/mL (interquartile range, 0.2-0.8), compared to 0.5 units/mL (interquartile range, 0.3-0.7) in the comparator group. Median time to first therapeutic anti-Xa level was a median 9.3 hours (interquartile range, 5.7-13.5) in the rivaroxaban group compared to a median 9.3 hours (interquartile range, 5.9-25.6) in the comparator group. Four patients in the rivaroxaban group received blood transfusions compared to two patients in the comparator group. No patients in either group required an anticoagulant reversal agent or had any reported adverse events due to their anticoagulation.

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Conclusion: No statistically significant difference in the first anti-Xa level was seen in this study. In addition, there was also no statistical difference in the time it took to achieve the first therapeutic anti-Xa level between the groups. Rivaroxaban therapy was not observed to affect anti-Xa monitoring in patients transitioned from rivaroxaban to heparin infusions.

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6-181

Category: Toxicology

Title: Gender differences and drug-related deaths

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Purpose: Prescription drug abuse is a growing problem in the United States. Central respiratory depressants, such as opioids and benzodiazepines (BZDs), are potentially lethal if misused or abused. Collecting, categorizing, and analyzing the demographic data may illustrate patterns of drug abuse which could aid in predicting and preventing future deaths. The purpose of this study was to investigate gender-specific patterns of opioid and BZD detection in post-mortem toxicology screens from drug-related deaths (DRD) recorded by the Ada County Coroners Office during 2011 and 2012

Methods: This study was exempt from Institutional Review Board approval due to the deceased status of the subjects. A retrospective review was completed on subjects identified from 2011-2012 autopsy and inspection reports at the Ada County Coroners office. Autopsy and inspection reports not warranting post-mortem drug toxicology screens were excluded. Data collected include post-mortem blood concentrations of over 100 different drugs, both legal and illicit. Data were recorded without patient identifiers and were handled to preserve confidentiality. Mantel-Haenszel chi squared analysis was performed to identify trends among decedents cause of death, positive drug detections, and post-mortem drug levels among opioids and benzodiazepines.

Results: One hundred seventy-one decedents (90 male, 81 female) were identified for study inclusion. The average age of all subjects was 44 years (females 46, males 43). The overall DRD rate from this population was 10.4/100,000, whereas and the opioid related death rate was 7.1/100,000. Although there was a higher incidence of opioid positive toxicology screens in males (53%) versus females (41%), the difference was not significant (p equal to 0.12). Females had a significantly higher incidence of drug screens positive for BZDs (47% vs. 28%, p less than 0.01) and for concomitant use of both BZDs and opioids(31% vs. 14%, p less than 0.05). Females also averaged a significantly higher number of drugs identified per decedent (6.5, +/- 0.5, vs. 4.8, +/-0.4, p less than 0.01) in this population.

Conclusion: While males showed a higher incidence of toxicology screens positive for opioids, the trend was not significant. There was a significantly higher incidence of positive drug screens for BZDs in females, which may correspond to increased prescriptive frequency for this drug class among females as compared to males. In addition, a significantly higher average number of drugs per decedent was identified among females versus males. This may indicate an additional risk among females with respect to polypharmacy and drug-drug interactions.

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6-182

Category: Toxicology

Title: Opioid and benzodiazepine drug-related deaths in Ada County, Idaho

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Purpose: The growing problem of prescription drug abuse is especially evident in regard to the increasing use and abuse of opioids and benzodiazepines (BZDs). As central respiratory depressants, both opioids and BZDs are potentially lethal if misused or abused. The purpose of this study was to identify relationships between drug-related deaths and opioids and/or benzodiazepines in post-mortem toxicology screens recorded by the Ada County Coroners Office during 2011 and 2012

Methods: This study was determined exempt from IRB requirements by the Institutional Review Board (IRB) due to the deceased status of its subjects. Data were obtained for this retrospective review from autopsy and inspection reports from the Ada County Coroners office for 2011 and 2012. Autopsy and inspection reports not warranting post-mortem drug toxicology screens were excluded. Data collected include post-mortem blood concentrations of over 100 different drugs, both legal and illicit. Data were recorded without patient identifiers and were handled to preserve confidentiality. Mantel-Haenszel chi squared analysis was performed to identify trends among decedents cause of death, positive drug detections, and post-mortem drug levels among opioids and benzodiazepines.

Results: During 2011 and 2012, 171 decedents (90 male, 81 female) met inclusion criteria. Average age of subjects was 44 years (females 46, males 43). Regardless of cause of death, 47% (80/171) of decedents tested positive for opioids, 37% (63/171) tested positive for BZDs, and 22% (38/171) tested positive for both opioids and BZDs. The average number of drugs per decedent was significantly higher in decedents testing positive for opioids (6.5, +/-2.6, range 1-12), BZDs (5.6, +/-2.9, range 1-12), and both opioids and BZDs (9.6, +/-2.9, range 4-15), versus decedents testing positive for neither drug class (2.8, +/-2.8, range 0-10). Decedents that screened positive for opioids demonstrated a 6.2 times higher likelihood of a drug-related death (DRD) (p less than 0.0001). Those that screened positive for BZDs had a 2.7 times higher likelihood of a DRD (p equal to 0.002). Decedents positive for both opioids and BZDs had a 6.0 times higher likelihood of a DRD (p less than 0.0001). There was a significant increase in the odds ratio (OR) of DRD in BZD positive decedents when detected drug levels were supra-therapeutic (OR 5.0, p less than 0.005), but no increase in odds ratio of a DRD in opioid positive decedents with supra-therapeutic levels (OR 5.5, p less than 0.0001)

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Conclusion: Post-mortem opioid detection demonstrated the strongest relationship to drug related death among substances detected in this study. Decedents positive for BZDs were also more likely to have a DRD, especially if the detected levels of BZD were supra-therapeutic. Decedents testing positive for opioids or BZDs also tested positive for more drugs on average, especially those testing positive for both opioids and BZDs. These findings indicate that further investigation may be needed into the potential risks of opioid analgesics, even at currently accepted therapeutic doses. Moreover, opioid and BZD users may be at higher risk for complications from polypharmacy.

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6-183

Category: Women's Health

Title: Role of the pharmacist in the management of premenstrual symptoms among female Lebanese pharmacy students

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Purpose: Premenstrual syndrome (PMS) affect many women of childbearing age, the symptoms can manifest as physical and/or psychological aspects. Pharmacy students often experience an undue amount of stress caused by the loaded curriculum. The exact causes of PMS are not clearly identified, but have been linked to different factors: hormonal changes, neurotransmitters, diet, drugs, activity and prostaglandins. The severity of the symptoms varies among the female population, and can sometimes interfere with daily life, affecting professional performance and social attitude. Management of the condition may range from lifestyle changes in mild/moderate cases to pharmacologic treatment in moderate/severe cases. The aim of the study is to assess the role of the community pharmacist in counseling pharmacy students on pharmacologic and nonpharmacologic management of PMS.

Methods: A cross sectional descriptive survey was validated, and then filled by randomly selected female pharmacy students from different professional years. The survey consisted of 25 questions comprising social and medical history, lifestyle habits, eating patterns, PMS symptoms, treatment and sources of counseling regarding the condition. The management section included nonpharmacologic and pharmacologic remedies, which comprise all non-steroidal anti-inflammatory drugs (NSAIDs) present on the Lebanese market, acetaminophen, antispasmodics, and the available combination products. This survey required 10 minutes to be filled and the data was analyzed using SPSS 20.0. The counseling section included whether the patients were informed about PMS management by a pharmacist, a physician, or they practiced self prescribing of any available remedy.

Results: Survey data was analyzed based on 105 females. The age of the candidates varied between 18 and 35 years old (mean of 22.6 years). The data revealed that 18.0% are smokers, 11.5% consume alcohol, 59.1% perform regular physical activity, 60.0% have family problems and 38.1% have work troubles. The most common premenstrual symptoms were a combination of the following: food craving and overeating (50.0%), depressed mood and lack of energy (45.0%), cramps and low back pain (41.6%), and headache (36.7%). Concerning the diet, the consumption of the different food categories was as follows: 69.5% consume fruits regularly, 82.0% eat vegetables on a daily basis, 82.9% on animal protein, 65.7% include cereals and legumes in their diet and 79.0% have dairy products within their meals. Some respondents reported taking supplements on daily basis, 18.2% are on iron, 11.5% on magnesium, 11.5% on

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calcium and vitamin D and 6.7% on a multivitamin formulation. The management of the symptoms was performed by NSAIDs (29.5% use ibuprofen, 23.8% ketoprofen, 22.8% mefenamic acid, 7.61% naproxen), acetaminophen (36.2%), antispasmodics (scopolamine and phloroglucinol: 26.7%), herbal remedies (anis, cumin, mint, sage, citronella and myrrh: 17.1%), or a combination of any. Only 24.76% of the candidates reported asking a pharmacist and 15.2% asking a physician about the management of their condition.

Conclusion: Based on the survey results, understanding the severity of PMS is important in college females and awareness campaigns to the community are therefore crucial, as derived from the pharmacy students experience. PMS itself cannot be prevented, but through education and appropriate pharmacologic and non pharmacologic treatment of symptoms, most females can find relief. Thus the importance of the pharmacist in guiding the management of PMS should be stressed on in the outpatient setting in order to decrease the abuse of pharmacologic options and their consequent toxicity. Finally, this study was performed on a sample of educated female community patients, who might underestimate the true findings of the actual population.

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6-184

Category: Women's Health

Title: Impact of non-pharmacological approaches and pharmacist counseling on urinary tract infections in Lebanese females

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Purpose: Urinary tract infections (UTIs) are one of the most common infections seen in general practice in the in- and outpatient settings. UTIs can be prevented by multiple approaches that can either be pharmacological or non-pharmacological. There is no enough literature in Lebanon and around the world to support the use of prevention techniques to decrease UTIs in females. The purpose of this study was to assess the impact of daily habits and non-pharmacological options in decreasing UTIs in the Lebanese female population, along with evaluating the role of the pharmacist in education on how to decrease the incidence of UTIs.

Methods: The institutional review board approved this cross sectional study, which was conducted from February to June 2014 in community pharmacies and university settings. In order to assess the history of the female subjects daily habits, a questionnaire on this matter was developed and the participants provided an oral informed consent to be enrolled in the study. The survey was composed of 23 multiple choice questions and required an average of 10 minutes to be filled. The pharmD candidate collected data, which included detailed demographics, educational level, sexual activity, history of UTIs, diabetes mellitus type 2 (DM2) and hypertension (HTN), exercise history, way of intimate area wiping, type and frequency of underwear change, fluid consumption, and history of the use of the following: intimate hygiene products, minipads, cranberry, vitamin C, coffee, cola, yoghurt, artificial sweeteners and others. In order to assess the patients knowledge, they were asked to fill a 14 item survey about general knowledge on UTIs. Upon completion, they were provided with a brochure that was explained by the pharmacist to clarify any misconceptions. After that, they were asked to refill the same survey in order to be able to assess the impact of pharmacist counseling on their knowledge about UTI prevention habits. All statistical analysis was performed using SPSS version 20.0.

Results: Survey data was analyzed based on 522 females aging 13 to 83 years old (mean of 24.82 years). The data showed that 14.9% were sexually active and 90.7% received university and graduate education. A pearson chi-square of p-value less than 0.05 was set to indicate statistical significance, and a logistic regression to adjust for all confounding variables was considered. Based on the chi square analysis, it has been realized that the following were statistically significant in affecting the frequency of UTIs: sexual activity, non-university educational level, use of intimate hygiene products, exercise, coffee, vitamin C, and HTN (p-value less than 0.05). Whereas, the logistic regression analysis resulted in loss of significance for

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the following variables: educational level, exercise, artificial sweeteners, cola, and HTN (p-value more than 0.05). However, those that remained significant and increased UTIs included: sexual activity, coffee, yoghurt, back to front intimate area wiping, and vitamin C use, while the use of intimate hygiene products decreased the incidence of UTIs (p-value less than 0.05). As for the impact of pharmacist counseling, it was noteworthy that after explaining the brochure, the patients had a mean increase of 3.354 in answering questions correctly based on the paired samples test.

Conclusion: The findings of this study show that sexual activity, coffee, yoghurt, back to front intimate area wiping, and vitamin C use increase UTIs, while only the use of intimate hygiene products decreases them. This indicates a potential need to review the content of current preventive educational strategies about UTIs. The validity of these findings must be further examined before a conclusive statement or recommendation can be made. Furthermore, the pharmacist-patient interaction has revealed to play a role in increasing patient awareness regarding UTIs prevention and non-pharmacologic alternatives.