

ASHP 2014 Summer Meeting Professional Poster Abstracts

1-M

Category: Cardiology / Anticoagulation

Title: Amiodarone associated death

Primary Author: Israa Jasim; **Email:** pharm18i@yahoo.com

Purpose: Prevent death due to wrong administration of amiodarone.

Methods: Made a poster for the CCU to prevent more death due to wrong injection of amiodarone. One of the cases died due to direct injection of 300 mg amiodarone over less than 10 min. Other was shocked & saved life by DC shoke.

Results: No more mistake with amiodarone happened again.

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2-M

Category: Cardiology / Anticoagulation

Title: Transition from intravenous or subcutaneous prostacyclin therapy to inhaled treprostinil in patients with pulmonary arterial hypertension: A retrospective case series

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Purpose: Inhaled treprostinil represents an attractive alternative to the other available prostacyclin formulations by obviating the use of intravenous or subcutaneous continuous infusions and their associated risks. Published evidence describing the process of transition from infusion prostacyclin therapy to inhaled treprostinil is limited. The purpose of this study was to describe the transition from intravenous or subcutaneous prostacyclin continuous infusion therapy to inhaled treprostinil in pulmonary arterial hypertension patients.

Methods: A retrospective case cohort study was performed after approval by the Institutional Review Board. Patients undergoing transition from intravenous or subcutaneous continuous infusion prostacyclin to inhaled treprostinil from July 2010 through November 2011 were included. Patient demographics, baseline medication history, along with pre- and post-transition hemodynamics, six-minute walk distance, World Health Organization functional class, modified Borg Dyspnea Score, and brain natriuretic peptide were obtained from the electronic medical record.

Results: All three patients were women. The average age was 47 plus or minus 12 years. Patient 1 and Patient 2 had idiopathic pulmonary arterial hypertension and Patient 3 had associated pulmonary arterial hypertension with limited scleroderma. All were on combination oral and infusion prostacyclin therapy. All three patients had been receiving intravenous or subcutaneous prostacyclin infusion for at least 2 years and were stable on a maintenance dose of epoprostenol 50ng/kg/min and treprostinil 59 and 65 ng/kg/min respectively prior to downward titration in preparation for conversion to inhaled treprostinil. Hemodynamics, six-minute walk distance, World Health Organization functional class, modified Borg Dyspnea Score, and brain natriuretic peptide prior to and after transition remained similar. All patients were receiving concomitant oral pulmonary arterial hypertension medications prior to and after conversion. Adverse effects during the change were mild. No patients discontinued inhaled treprostinil following transition. At long-term follow-up, functional class remained stable at World

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Health Organization functional class II or better. Patient 1 and Patient 3 demonstrated stable to modest improvement in 6 minute walk distance while Patient 2 had a slight decrease in 6 minute walk distance.

Conclusion: The transition to inhaled treprostinil from intravenous or subcutaneous continuous infusion prostacyclin therapy appears to be safe in carefully selected patients.

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3-M

Category: Cardiology / Anticoagulation

Title: Adherence to oral anticoagulation therapy among patients with non-valvular atrial fibrillation

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Purpose: In recent years, several novel oral anticoagulants (OACs) have been approved for stroke prevention in atrial fibrillation (AF) patients. These new agents offer alternatives to warfarin therapy, which is associated with variable patient response and requires frequent patient monitoring. Even though medication adherence with chronic medication has become an integral part of quality of care, there are limited published data on patient-reported medication adherence for oral anticoagulants with different dosing frequency. The purpose of this study was to assess patient-reported medication adherence among AF patients who use Warfarin (typically once-daily) and dabigatran (twice daily).

Methods: A 12-month longitudinal patient survey study, including eligible non-valvular AF patients receiving warfarin or dabigatran therapy between 10/01/2011 and 9/30/2012 and identified utilizing administrative claims from the HealthCore Integrated Research Database (HIRD), was approved by a central institutional board. This ongoing longitudinal survey study consists of assessments at study enrollment (baseline) and at 4-month intervals. Participating patients completed a 30-minute survey which included questions on demographics, the Morisky Medication Adherence Scale (MMAS), and other validated patient-reported outcomes instruments. This pre-specified descriptive analysis focused on patient-reported adherence measured by the 8-item Morisky Medication Adherence Scale (MMAS), which has an overall score ranges from 0 to 8 with higher scores indicating greater adherence. Descriptive analyses of interim baseline MMAS data were performed.

Results: Baseline MMAS data were available from 323 warfarin and 235 dabigatran patients. Dabigatran patients were slightly older (mean age: 65.0 versus 63.9 years), more likely to be male (67% versus 56%), had NVAf for a shorter period of time (mean duration: 4.6 vs. 7.9 years), and more likely to have used other blood thinner medication prior to current therapy (83.4% vs. 41.9%). Overall mean baseline MMAS scores were similar for both cohorts (mean (SD) =7.3 (0.8) for warfarin and 7.3 (1.0) for dabigatran). Examination of individual MMAS items at baseline showed that, compared to warfarin-treated patients, higher proportion of dabigatran patients reported to have days that they did not take

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current blood thinner medications over past two weeks (17.4% vs. 12.4%), feel hassled about sticking to their blood thinner treatment plan (17.4% vs. 14.0%), and have difficulty remembering to take all of their blood thinner medication once in a while or sometimes (14.9% vs. 10.2%). Results for the other MMAS items were similar for both cohorts (dabigatran vs. warfarin).

Conclusion: Overall self-reported adherence was similar between dabigatran and warfarin patients. However, item-level analysis suggested that there may be differences in patient reported adherence between dabigatran and warfarin in certain aspects. Further research is needed to understand how treatment complexity (including dosing frequency and monitoring requirements) along with other patient characteristics may affect medication adherence of OAC therapy.

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5-M

Category: Clinical Service Management

Title: Impact of hospital pharmacy on Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Survey Results

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Purpose: The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey is a standardized instrument that assesses perceptions of patients on their hospital stay created by the Center for Medicare and Medicaid (CMS). Survey scores are calculated based on the percentage of patients that respond to each question with either yes or a score of 4, which in turn become utilized for reimbursement purposes by the CMS. The HCAHPS survey items include two medication-related questions in which patients are asked to rate how well the hospital staff communicated about indication and side effects of new medications given during their hospitalization. The objective was to determine the frequency and types of pharmacist-patient encounters needed to improve the percentage of patients who respond to medication-related HCAHPS questions with a score of 4.

Methods: All discharged patients who returned completed HCAHPS surveys to the study institution between January, 2011 and October, 2013 were included, with the exception of those that did not answer the medication-related questions. Results of all HCAHPS surveys were linked to electronically-documented notes written by pharmacists and pharmacy interns by matching patient-specific encounter numbers. Based on the presence or absence of pharmacy notes, patients were divided into two different groups for the purposes of statistical analyses. Patients who do not have any documented pharmacy notes serve as the control group of this study. The patients who had one or more documented pharmacy note were further divided into multiple groups based on the types of pharmacist-patient encounters they experienced. The primary endpoint was the difference in the proportion of patients rating medication-related questions on HCAHPS surveys with a score of 4 among the study groups. The secondary endpoints were the difference in the proportion of patients rating medication-related questions with a score of 4 among the groups by the frequency and types of pharmacist-patient encounters. Students t-test, two- and multiple-sample proportion statistical tests were utilized as appropriate. All reported p values were two-sided with the alpha set at a significance of 0.05.

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Results: A total of 8,919 patients were included with approximately 30% of these patients (n=2,665) having one or more documented pharmacy note. At baseline, statistically-significant differences were observed between the study groups with regard to age, gender, healthcare payer type, as well as their hospital length of stay. With regard to the primary endpoint, no statistically-significant differences were observed between the control group and the patients whose medication history was taken by a pharmacist in the emergency department. Adding medication education during their inpatient stay also did not result in a statistically-significant difference. There was a trend toward higher percentage of patients who rated 4 for both questions when discharge counseling by a pharmacist was added to the combination of medication history and medication education. With regard to types of pharmacy notes, a statistically-significant improvement in the percentage of patients who gave a score of 4 for the medication side-effect question was shown in patients who received either transplant medication education (46.91% vs. 59.06%, $p=0.007$) or warfarin education (46.91% vs. 75.61%, $p<0.05$) by a pharmacist. Additionally, a statistically higher percentage of patients with four or more extensive pharmacist-patient encounters gave a score of 4 for the medication indication question.

Conclusion: The results of this study indicate that the presence of documented pharmacy notes is not associated with higher percentage of patients rating medication-related HCAHPS questions with a score of 4. However, more than four extensive pharmacist-patient encounters were shown to improve the percentage for the medication indication question. In addition, transplant medication and warfarin education was shown to result in statistically-significant improvement in the percentage of patients rating side-effect medication question with a score of 4.

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6-M

Category: Clinical Service Management

Title: Pharmacists documentation in patient medical records

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Purpose: The practice of documentation is a component of healthcare intended to facilitate information flow with regard to continuity of care, safety and quality of care. Documentation in the medical record by pharmacists varies across the practice of pharmacy. As the profession continues to push forward with provider status as well as credentialing and privileging, pharmacists documentation in the medical record is essential. Currently, there are no known statistics regarding these activities by pharmacists. The American Society of Health-System Pharmacists (ASHP) Section of Clinical Specialists and Scientists Executive Committee developed a survey to characterize the landscape of documentation in the medical record by pharmacists today.

Methods: A link to an online survey was distributed via ASHP Connect Discussions to the Sections of Clinical Specialists and Scientists and Inpatient Care Practitioners Communities in November 2013. Results were collected via Survey Monkey and tallied in January 2014. Pharmacists were asked which interventions or issues are documented in the medical record and which medications or pharmacy services prompt documentation. The responders institutions name and geographical location was obtained. Responders were also allowed to write in free text other services and medications that are documented at their institution by the pharmacist in the medical chart.

Results: There were 260 individual responses to the survey representing 251 institutions and 40 states. More than 90% of responders stated documentation in the medical records occurs for pharmacokinetic and anticoagulation services. Renal dose adjustments (74.6%), IV to PO conversions (58.8%) and medication reconciliation (58.1%) followed. Discharge counseling (56.9%), therapeutic substitution (54.2%), and antibiotic stewardship (53.8%) were the other descriptors that were documented in the chart by more than 50% of responders. Vancomycin (94.1%), aminoglycosides (92.9%) and warfarin (88.2%) were the top three medications that resulted in pharmacists documentation. Parenteral nutrition (65.7) and heparin (53.1%) were the other medications that more than 50% of responders documented. Unique actions documented were delirium screen, medication wean plans, and anemia

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management. Low molecular weight heparin, metformin, and several cardiac medications such as argatroban, apixaban, or rivaroxaban, were listed as other medications that can lead a pharmacist to document. Free text responses reported varied levels of pharmacist involvement in documentation within a single institution and inconsistency in services documented.

Conclusion: Pharmacists in multiple institutions are documenting in the medical record but inconsistency exists nationwide. Not all pharmacists are documenting, services are not documented consistently between pharmacists nor are they consistent between hospitals and the level of documentation provided is variable amongst both pharmacists and hospitals. Of those who document in the medical record, pharmacokinetic and anticoagulation services are among the most common pharmacy activities noted with vancomycin, aminoglycosides, and warfarin being the most common medications prompting documentation. However, unique services and medications are also allowing the pharmacist to document in the chart. Expanding the documentation of pharmacy services in the medical record is important to the advancement of pharmacists as providers. There is a need for standardization of documentation practices within the profession to enhance patient care and market pharmacy services rendered both internally and externally to the public at large. Future investigations to validate documentation methodology and identify practice areas best suited for documentation of services are warranted.

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Category: Clinical Service Management

Title: Transitions of care: pharmacists impact on family medicine physician adherence to three clinical practice guidelines

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Purpose: The use of evidence-based clinical practice guidelines for managing heart disease and diabetes is shown to decrease morbidity and mortality, hospitalizations, and increase quality of life. Pharmacists play a key role in ensuring adherence to these guidelines and improve medication optimization for these disease states. Patients with heart disease and diabetes are admitted to hospitals for various reasons and many therapeutic interventions are made or suggested by the interdisciplinary team. Upon discharge and follow up with the primary care physician (PCP), many of these interventions are lost, forgotten, discontinued, or not communicated. This results in inappropriate care, misunderstanding, nonadherence, and even readmission. The aim of this study is to determine if electronic pharmacist recommendations to family medicine physicians improve the adherence to three clinical practice guidelines upon discharge from the hospital in order to improve continuity of care.

Methods: This study was performed at a non-profit teaching hospital in northeast Ohio. Family medicine clinic patients that were admitted to the affiliated hospital for an acute condition were monitored by a clinical pharmacist for appropriate drug therapy. During the admission, chronic disease states were also assessed and verbal recommendations to the inpatient physicians were made accordingly. This process represents the control group. The intervention group was the pharmacist making those same recommendations in addition to written notes to the PCP in the outpatient electronic chart upon discharge from the hospital. Three disease state guidelines, heart failure, acute coronary syndrome, and diabetes, were assessed in this study. Medication optimization recommendations, where appropriate, targeted ACE-inhibitors or ARBs, beta blockers, aspirin, and statins. Data collection began following IRB approval in April 2013 and was completed in December 2013. Patient demographics such as age, sex, number of prescribed medications, and vital signs, clinical diagnoses, pertinent labs, experience level of PCP, and if the PCP prescribed the recommended medications were collected.

Results: A total of 64 patients were included in the study with 49 in the intervention group and 57 in the control group. Some patients had more than one indication for intervention. There were no significant differences in baseline characteristics between the two groups with respect to patient demographics and other variables such as chronic kidney disease, smoking, hypertension, and hyperlipidemia. The primary outcome of an action made by the PCP at one month post discharge occurred in 30/49 (61%) in the intervention group and 4/57 (7%) in the control group. This was a statistically significant 870% increase with a p-value < 0.001. Of the 30 actions in the intervention group,

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20 were medication additions according to recommendations made in the note to the PCP. There was no association in prescribing differences between varying physician experience, specific medication recommendations, or disease state.

Conclusion: The results of this study show that written pharmacist interventions results in improved adherence to guidelines and enhances the transition of care from inpatient status to outpatient follow-up. Although not directly assessed in the current study, medication optimization may decrease readmission rates and improve patient outcomes. The promising findings of this study have resulted in the extension of clinical pharmacy into the outpatient clinic and the expansion of pharmacist recommendations upon discharge to include medication therapies for multiple disease states.

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8-M

Category: Clinical Service Management

Title: Clinical pharmacokinetic parameters of vancomycin in Korean neonates and infants

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Purpose: Vancomycin, an effective antibiotic against gram-positive infections, has a narrow therapeutic window (peak: 25-40 mcg/ml, trough: 5-15 mcg/ml). Despite its effectiveness, risk of nephrotoxicity and ototoxicity calls for therapeutic drug monitoring (TDM), especially with pediatric patients known to have higher vancomycin clearances and shorter half-lives compared to adults and therefore are prone to have low trough levels. International standards are commonly used in providing TDM services. The objective of this project is to describe the actual clinical pharmacokinetic parameters and plasma concentrations of vancomycin in Korean pediatrics and consequently compare it with international standards to assess if it truly is safe to refer to foreign references.

Methods: The clinical pharmacokinetics of vancomycin were evaluated in 16 cases, which involved Korean neonates and infants below the age of one, registered for TDM service during May 2013 to January 2014. Three pharmacokinetic parameters (clearance, half-life, volume of distribution) and vancomycin plasma concentrations investigated in this study were collected retrospectively during routine therapeutic drug monitoring. Pharmacokinetic parameters were calculated by CAPCIL computer program (Simkin Inc) based on 2-compartment model and single point linear method utilized in the program. Plasma concentrations checked after at least one TDM service were analyzed to evaluate the appropriacy of current TDM recommendations. International references used in this study were Micromedex (Truven health analytics Inc) and Pediatric dosage handbook (16th edition, Lexi-Comp Inc).

Results: The average height and weight of Korean neonates and infants were 36cm and 1.72kg. Reference pediatric pharmacokinetic parameters of vancomycin (Micromedex) and the average of Korean pediatric parameters were as follows: clearance (ml/hour/kg) = 66-120 vs 55.34, half-life (hours) = 5-11 vs 12.5, volume of distribution (L/kg) = 0.565 vs 0.72. On average, 11.85 mg/kg/dose of vancomycin were given every 12.5 hours and as a result, an average of plasma concentrations were 24.84 microgram/ml for peak and 10.27 microgram/ml for trough level.

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Conclusion: Compared to international standards, Korean neonates and infants had lower clearance, upper-limit half-life, and higher volume of distribution. The average of vancomycin dosages actually injected corresponded with international recommendations (10-20 mg/kg/dose given every 8 to 12 hours), which resulted in both therapeutic peak and trough concentrations. Therefore, as TDM consultations based on international recommendations resulted in therapeutic vancomycin plasma concentrations, it is not unreasonable to refer to foreign standards. This study has its limitations in small main data and absence of differentiation between full-term, premature neonates due to lack of reliable reference parameters. However, parameters collected in this study may be used as a tip for pediatric vancomycin therapy, in that pharmacokinetics may differ with ethnicity and therefore referring to international standards should be done with reasonable flexibility. Also, as Korean pediatrics generally showed low vancomycin clearance and upper-limit half-life of 12.5 hours, this study hopes to remind professionals in concern to take extra care in assessing renal functions and be aware not to recommend short dosing intervals which may increase trough concentrations to toxic levels.

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9-M

Category: Clinical Service Management

Title: Evolution of an Antimicrobial Stewardship Program at a Community Hospital

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Purpose: An antimicrobial stewardship program (ASP) was initiated at our hospital in response to the growing global danger of antimicrobial resistance and warnings from the US Centers for Disease Control and Prevention and the Infectious Diseases Society of America. Our program was started five years ago under the auspices of the Pharmacy and Therapeutics (P&T) Committee in an effort to optimize the appropriateness of antimicrobial use while simultaneously improving patient care. We will describe the development of this program over those five years while including strategies with effective outcomes and our plans for the future.

Methods: Building on the existing infrastructure of our parenteral-to-oral and renal dose adjustment program, the initial phase of our strategy was to target selective broad-spectrum antibiotic usage. A clinical pharmacist working with the medical director of antimicrobial stewardship is responsible for reviewing cases for opportunities to de-escalate therapy. Our initial focus was to establish a daily prospective audit routine and provide feedback to the medical staff on antibiotic monitoring. Intervention and outcome data reports were presented to the P&T Committee quarterly, including potential recommendations pertaining to organism susceptibilities, indication of therapy, parenteral-to-oral conversion, renal dosage adjustments, duplication, de-escalation and duration of therapy. Our long term strategy was to develop tools to assist the ASP for expansion. Over time, we collaborated with our long established Antimicrobial Committee to revitalize activities and drive changes to facilitate system improvement. Some of the key initiatives we pursued included mandatory intended indication on antibiotic order entry; antibiogram trending and alerts to medical staff; expanded formulary restriction with required preauthorization; conducted various in-house studies to improve appropriate use of antimicrobials; changed dosing regimen of beta-lactam antibiotics to optimize pharmacokinetics and pharmacodynamics. A recent initiative also included the promotion of both nasal and throat cultures to facilitate discontinuation of empiric vancomycin for suspected methicillin-resistant *Staphylococcus aureus* (MRSA) healthcare-associated pneumonia. Past antimicrobial stewardship activities also included guideline education at medical staff department meetings and order set development. More recently we have expanded the ASP to review all cases of bacteremia with an eye for appropriate antibiotic use. Looking to the future we anticipate expanding the scope of our ASP by gradually incorporating antibiotic

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stewardship in clinical pharmacy routines on rounds. With the lack of new antimicrobial agents in the development pipeline, we seek to incorporate rapid diagnostic testing and biomarkers to shorten therapy and reduce antimicrobial exposure. Along the same line, use of clinical decision support technology with the help of a strong information system specialist cannot be overlooked. We like to strengthen the current surrogate outcome measurement from defined daily dose (DDD) to obtaining data related to antimicrobial resistance to observe more practical and meaningful data.

Results: More than 700 cases of antimicrobial reviews were conducted since the inception of the ASP during the first year. This number increased each year through 2013, when we exceeded 1600 reviews. On an annual basis, over 600 (not including parenteral-to-oral conversion and renal dose adjustment) recommendations were made with greater than 80% acceptance rate. The metrics for total DDD per 1000 patient days and cost per acute patient day based on utilization have been very favorable compared to external benchmark hospitals. We attribute our favorable results to several factors. Merely maintaining an ASP with persistence has shown improved physician awareness of appropriate use of antibiotics. In addition, reminders for formulary restriction and preauthorization, routine calls to recommend appropriate antibiotic options all seem to contribute to guideline compliance.

Conclusion: Our ASP has come a long way in the five years since its inception. A measure of success for our ASP has been the favorable metrics compared to industry benchmark. We hope to build on this success by focusing on reductions in the incidence of nosocomial infections and other multidrug resistant pathogens. We understand the challenges continue and seek innovative tools and methods to refine and grow with the program.

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10-M

Category: Critical Care

Title: Comparison between propofol and dexmedetomidine in easy weaning of mechanical ventilator among patients in medical intensive care unit in Qatar.

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Purpose: The study aimed to compare the effect of propofol and dexmedetomidine in easy weaning of the ventilator among patients admitted to medical intensive care unit.

Methods: a retrospective cohort study among adult patients who admitted to MICU Inclusion criteria Subjects above 18 years of age, between January December 2012. Required mechanical ventilation for more than 72 hours due to medical reasons particularly respiratory failure, pneumonia, hypovolemic shock, sepsis or any other neurological condition such as intra cranial hemorrhage and received the Propofol or Dexmedetomidine as a sedative medication during the period of mechanical ventilation. Exclusion criteria the subjects were excluded if the records were incomplete especially on primary and secondary outcome variables such as the recording of time between cessation of medication to extubation, any side effects, and concurrent administration of any other sedative, opiate analgesic, and/or any other drug along with the primary sedative medication. more patients excluded if they were tracheostomized and referred out to the rehabilitation facility. and subjects who died during ventilation before extubation were excluded and at the end those who travelled abroad for further treatment without extubation were also excluded from this study. Statistical analysis The data was analyzed using SPSS version 21 Ethical considerations The research proposal was approved by the ethical review committee of Hamad Medical Corporation in Qatar. Since direct patients recruitment was not involved in this study therefore consent seeking was waived off. However, confidentiality of the subjects were ensured by recording the data on anonymous questionnaires .

Results: Total 51 patients were being administered with either Propofol (n=21) or Dexmedetomidine (n=30) during the study period. Among those administered with Propofol, 3 patients died before extubation, 1 patient travelled abroad for treatment without extubation, and 1 patient was tracheostomized leaving 17 patients on Propofol treatment that were extubated and analyzed in this study. On the other hand, total 30 patients received Dexmedetomidine during the study period. Out of

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them, 5 patients died before extubation, 2 patients failed extubation, and 2 were tracheostomized resulting in 21 patients on Dexmedetomidine that were extubated and analyzed in this study. Total 37 patients fulfilled the eligibility criteria during the study period. Out of 37, only 17 patients had received propofol and the remaining 21 received dexmedetomidine. The distribution of both genders was equal in propofol group and male were three times higher in dexmedetomidine group, however the difference was not statistically significant. Overall, the average duration between cessation of medication to extubation was 2.4 hrs. The period was slightly higher for patients administered with propofol as compared to dexmedetomidine however the difference was not statistically significant (2.5hrs vs. 2.3; $p=0.633$, respectively). Hypotension, bradycardia and agitation were the most common side effects of both the medication. The average score on RSS was significantly higher for the patients that received Dexmedetomidine as compared to Propofol (3.5 vs. 2.9; $p=0.049$).

Conclusion: Propofol and Dexmedetomidine have similar effect in terms of easy weaning of ventilator and adverse effects among medically ill patients. Dexmedetomidine resulted in deeper sedation than Propofol. Further studies with prospective design or randomized control trials are needed to confirm the findings of this study.

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11-M

Category: Drug Information

Title: Review of new molecular entities for information on dosing in obese patients

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Purpose: Obesity rates are growing at an alarming rate across the world. Obesity is known to influence the pharmacokinetics of certain drugs, so it is crucial for physicians and pharmacists to have access to information on dosing in obese patients to ensure the safe use of drugs in this population. For newly approved drugs product inserts are often a primary source of drug information. The purpose of this project was to review the product inserts of non-biologic new molecular entities (NMEs) approved by the US Food and Drug Administration (FDA) for information on dosing in obese patients.

Methods: 172 product inserts of 71 non-biologic NMEs approved by the FDA from January 2009 to June 2012 were reviewed for information on dosing and pharmacokinetics in obese patients. The availability of information on dosing in obese patients was cross-referenced with the Drug Information Handbook (DIH) and Drugdex. DIH and Drugdex were selected as they were two of the most popular references among physicians and pharmacists in previous surveys.

Results: 24 of 71 (34%) NMEs reviewed possessed the information of interest in their respective product inserts. These were further categorized into NMEs with bodyweight-based dosing information ($n = 9$), NMEs with body surface area (BSA)-based dosing information ($n = 5$), and NMEs with non-bodyweight-based and non-BSA-based dosing information ($n = 10$). NMEs with bodyweight-based and BSA-based dosing information possessed limited information on whether this information could be generalized to the obese population. NMEs with non-bodyweight-based and non-BSA-based dosing information provided more definitive information on dosing in obese patients, including seven NMEs indicating specifically in their product inserts that dose adjustment was not necessary based on the weight or BMI of patients. Results of the cross-referencing with DIH and Drugdex found no information for the 46 NMEs that did not possess information of interest in their product inserts. This highlights a limitation to retrieving information from drug references on dosing in obese patients that is neither bodyweight-based nor BSA-based.

Conclusion: This review revealed insufficient information on dosing in obese patients available in product inserts and common drug information references for non-biologic NMEs. This poses a problem for physicians and pharmacists when dosing these drugs in obese patients.

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12-M

Category: Drug Information

Title: Student perceptions of and performance in a blended foundational drug information course

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Additional Author(s):

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Purpose: Online technologies continue to spur educational innovations. Based upon student feedback from annual assessments and to accomplish institutional strategic objectives, the foundational drug information course for first-year pharmacy students in a 2+4 pharmacy program was revised into a blended learning model. The primary purpose of this project was to assess and trend opinions about student learning preferences in this 5-week (1 semester credit hour) course. Secondary objectives compared the mean final examination score, overall mean course grade, and changes in standardized university course evaluations between the 2012 and 2013 offerings of this course.

Methods: The course was modified by using narrated video instruction (Camtasia and Articulate Storyline) to replace traditional face-to-face lectures while also maintaining use of a traditional face-to-face weekly laboratory session to reinforce important concepts from videos. All students enrolled in the course (n equals 127) were solicited to voluntarily participate in this cross-sectional research project that utilized pre- and post-exposure surveys. The electronic survey link for the pre-exposure survey was distributed via the email list serve for the first-year class during new student orientation and the post-exposure survey link was distributed after the course final exam. Students were asked to rate their opinions of learning preferences using a 5-point Likert scale. Mean scores for standardized course evaluation results as well as final examination and overall course scores were compared between the 2012 and 2013 entering classes. Statistical analysis for all endpoints was conducted using paired t-tests. The university IRB approved this research.

Results: Of 127 students in the class, 115 (90 percent) completed the pre-exposure survey and 88 (76 percent) completed the post-exposure survey. Only matched pairs who completed both the pre- and post-exposure surveys were analyzed for this project (n equals 65; 51 percent). Overall, paired analysis of questions regarding student learning preferences reflected favorably on the structural changes instituted in the course. Specifically, the change between mean pre- and post-survey results for opinion-based items indicated a decline in student favorability for traditional lecture styles (difference equals - 0.49 points; P less than 0.0001) and importance of face-to-face interactions with instructors outside of

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the classroom (difference equals -0.46 points; P equals 0.0002), while demonstrating increased favorability for use of online video demonstrations as an acceptable substitute for in-person demonstration of skills (difference equals 0.34 points; P equals 0.02) and overall preference of online learning compared to traditional modalities (difference equals 0.44 points; P equals 0.0008). No statistically significant differences existed for changes of opinion in survey items assessing importance of in-class interaction with classmates and importance of the ability to ask questions during class. The mean score on the standardized course evaluations completed by students did not significantly differ between the 2012 and 2013 cohorts (n equals 107 and 106, respectively). Mean final exam scores for the 2012 and 2013 cohorts, using the same instrument, significantly increased from 84.86 percent to 88.99 percent (P equals 0.0003), while mean course grades were similar between the 2012 and 2013 cohorts (94.03 percent and 93.62 percent, respectively; P equals 0.36).

Conclusion: The results of this project indicate that a blended course design can be an effective pedagogical technique in a foundational skills-based course for first-year doctor of pharmacy students. The modifications to this course were favorably received, generated significant changes with respect to 4 of 6 opinion-based items related to student learning preferences and will be considered for other skills-based courses in the curriculum.

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13-M

Category: Drug Information

Title: Usefulness of drug information website accessed by cell phone data connection via two-dimensional matrix barcode

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Noriyuki Namiki

Purpose: Access to drug information by patients plays an important role in pharmacotherapy. By use of a drug information service system through internet access by cell phone, a quick response (QR) code printed on the drug package provides access to information on a website. This system is expected to be useful for promoting appropriate drug use by patients, as they are able to easily obtain drug information in a timely manner. In this study, we performed questionnaire survey in pharmacy students and patients to clarify the usefulness of drug information websites accessed using a QR code.

Methods: The first- and second-year, and the fourth- and fifth-year pharmacy students at University of Shizuoka, outpatients treated with amlodipine, and families of pediatric patients treated with antibiotics at Jikei University Daisan Hospital were surveyed. Consent for participation in the survey was obtained from the students and patients (and/or their families) after the purpose and method were explained. All subjects were given a cell phone and explanation how to use it, and then asked to use the phone to read QR codes to access drug information websites for both amlodipine (Amlodipine OD tablet eTowaf) and/or cefcapene (Cefcapene granules for children eTowaf). The drug information websites for the drug information service system accessed using a QR code were kindly provided by Towa Pharmaceutical Co., Ltd. (Osaka, Japan). The questionnaire items had a total of 33 questions in 3 different categories, which were utilization of a cell phone and the internet, the drug information websites for amlodipine and cefcapene, and evaluation of the drug information service system accessed using a QR code. The subjects were asked to select one answer each among the choices for each question.

Results: The mean age of the students in the first and second years ($n = 50$) and in the fourth and fifth years ($n = 50$) were 18.6 and 22.0 years old, respectively, while that of subjects in amlodipine ($n = 50$) and cefcapene ($n = 50$) groups were 56.6 and 31.7 years old, respectively. Use of a cell phone to access the internet was noted by 18-24% of the students, while that answer was scarce among subjects in amlodipine and cefcapene groups. When asked whether the information websites for amlodipine and cefcapene were easy to view, use, and understand, more than 80% of the students and patients evaluated it positively, answering gYesh or gRelatively yesh. Regarding its usefulness, convenience, ease of use, and speed, nearly all subjects evaluated it positively. Moreover, for the question gDid you obtain

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the information that you were looking for?h, nearly all of the subjects answer gYesh for each website. For the question gWould you like to access similar websites for other drugs in addition to amlodipne or cefcapene?h, more than 90% of all subjects answered positively. Furthermore, in evaluations of the convenience and simplicity of the system, more than 90% of the subjects answered positively.

Conclusion: The present results confirmed that the present drug information websites accessed via a cell phone using a QR code is a useful and fast means of obtaining drug information for patients. We also consider that the significance of the system might increase more as cell phone use and technology progresses.

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14-M

Category: Drug-Use Evaluation

Title: Evaluation of the use of liposomal bupivacaine in knee replacement patients in a community hospital setting

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Additional Author(s):

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Purpose: Exparel is an extended release formulation of bupivacaine which has been advertised to benefit patients by decreasing the length of stay and reducing the need for IV opioids after surgery. The purpose of this project is to evaluate the cost benefit and patient benefit of Exparel use in knee replacement patients in a community hospital setting.

Methods: An electronic record search will be conducted to identify knee replacement patients from June 2013 - present. Patients from June 2013 - Sept 2013 will be compared to patients from October 2013 - present since Exparel was introduced to the hospital formulary after October 2013. Areas of comparison will include pain management scores for post-operation days 1-3, PCA use, length of stay, opioid use. A 5 question survey will be sent to surgeons at our institution to assess their use of Exparel as well.

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15-M

Category: Drug-Use Evaluation

Title: Minimizing bias in observational studies when Big Data are not available: A Drug utilization evaluation (DUE) case study of a newly marketed drug for postsurgical pain, bupivacaine liposome injectable suspension

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Purpose: While much promise exists for Big Data, situations occur where limited data are available to guide decisions, such as when conducting drug utilization evaluations for new drugs. Assessments of new innovative therapies in the postsurgical setting are particularly daunting due to incomplete information that is not readily accessible from administrative data. The objective of this study is to describe steps taken to minimize bias when designing a drug utilization evaluation to evaluate bupivacaine liposome injectable suspension, a long-acting non-opioid local analgesic Food and Drug Administration approved in October 2011 for postsurgical pain.

Methods: Prior to commencement, this study was submitted to the Institutional Review Board for approval. The drug utilization evaluation is designed to measure the impact of bupivacaine liposome injectable suspension following total knee arthroplasty on post-operative pain, ambulation, physical therapy assessment, length of hospital stay, and total procedure cost. Using propensity score matching a historical cohort of control patients, who received elastomeric pump (cost \$646) rather than bupivacaine liposome injectable suspension (cost \$285), were matched for clinical and demographic characteristics. Sample size calculations for each outcome were based on economic and clinical data from previous clinical trials and observational studies.

Results: Although basic clinical and demographic data were available to select historical controls, potential confounders such as chronic opioid use, preoperative pain severity, and other co-morbidities (e.g. psychiatric, etc) could not be ascertained. In addition, total hospital costs per patient varied widely between surgeons and inability to completely control and standardize differing modes of pain management. Sample size calculations determined that 358 participants were required in each group. To date, 125 bupivacaine liposome injectable suspension and 239 historical controls have been recruited. Preliminary results suggest potential savings of \$388 per patient in the bupivacaine liposome injectable suspension group.

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Conclusion: Early post-marketing total knee arthroplasty drug utilization evaluation studies are susceptible to bias related to limited data availability to select matched historical controls and physician practice variation. Adoption of new treatment requires physician protocol consensus to reduce the variation across surgeon practice and thereby lead to improved health care decision.

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16-M

Category: Drug-Use Evaluation

Title: Cytotoxic drug waste impact on pharmacy budget

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Purpose: The past years have seen a significant and progressive cost rising in cancer treatments, largely due to increase in prevalence and use of highly expensive drugs. Drug wastage leads to economic loss, but little is known about the size of this problem.

Methods: Barzilai Medical Center provides medical hemato-oncology services for 300 patients (average) per year. Facilities include a 25 bed day hospital service and 10 bed ward. A complete centralized unit for drug preparation is run by hospital pharmacists. Waste of cytotoxic drugs was calculated as the difference between the total amount of each drug prescription and real amount of consumed drugs. In this framework, a project to reduce drug waste was designed and launched starting 2009. Basis for comparison was the data gathered on waste percentage for whole year 2008. In order to reduce waste rate, pharmacy and hemato-oncology departments introduced a new protocol. It consisted of two corrective measures; rational distribution of chemotherapy treatments during the week and reasonable rounding of drug dosages, approved by physicians. If drug instability was the basis of drug waste, we used when possible multi-dose vials that retain a much longer microbial and chemical stability or prolonged the stability of the reconstituted drugs based on literature information. Referring the second measure, we used dose rounding to within 5% of calculated dose, since on the basis of pharmacokinetic and clinical issues this dose adjustment is not expected to have any significant effect on either response or toxicity. All staff members were provided with a leaflet indicating the most reasonable dose rounding depending on body surface/weight and available vial size. Protocol of waste reduction was shared with all staff members and formally adopted.

Results: Base line analysis focused on 30 drugs during year 2008 with an average drug waste of 11.45%. After intervention protocol, wastage was calculated as an average value for the following five years (2009-2013). Average wastage equaled to 2.55%. A major impact on wastage decrease was attributed to 5 drugs: Bortezomib, Cetuximab, Topotecan, Pemetrexed and Docetaxel.

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Conclusion: The model implemented played a key role in reducing wastage of cytotoxic drugs and cost savings.

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17-M

Category: Drug-Use Evaluation

Title: Prevalence and risk of thrombocytopenia in psychiatric patients taking valproic acid

Primary Author: Shang-en Wu; **Email:** jesuispharmacien@gmail.com

Purpose: Valproic acid (VPA) is a commonly-used anti-epileptic agent, it is usually used alone or in combination with other anti-epileptic agents to control seizure outbreak. VPA possesses wide range of indications, including complex seizure, migraine prophylaxis, acute phase of bipolar disorder; however, the most commonly-seen adverse effect of VPA is thrombocytopenia (10~24%). Thrombocytopenia potentially attenuates the blood aggregation and may elevate the risk of hemorrhage in patients with cardiovascular problems also. In this study, we tended to figure out the prevalence of valproic acid-induced thrombocytopenia via analyzing the contributing factors, such as VPA daily dose, sex, age, plasma VPA trough level, the level of platelet count, and concomitant drugs which may cause thrombocytopenia. Meanwhile, we observed the occurrence of haemostatic problems associated with thrombocytopenic subjects.

Methods: In this retrospective study, we collected 225 subjects admitted in a regional psychiatric teaching hospital and diagnosed as bipolar disorder from January 1, 2009 to December 31, 2013. Analyzing the relationship between thrombocytopenia and the VPA administration was performed by using x2 statistics to evaluate contributing factors of sex, age, VPA dosage, and plasma VPA trough level. Using the Fisher exact (two-sided) test, we identified whether administration of concomitant drugs will contribute to remarkable decrease of platelet count. Besides, we had the observation on the occurrence of haemostatic problems in subjects met the criteria of thrombocytopenia. All subjects provided informed consent.

Results: Among 225 hospitalized subjects, 47 (20 %) met the criteria of thrombocytopenia, 97 (43 %) had only one platelet count, which meant platelet counts during VPA treatment were not available. In those of thrombocytopenic subjects, mild to moderate thrombocytopenia accounted for 24 subjects (51 %) and 10 subjects (21 %) had the VPA dosage modification. In those subjects with only one platelet count, 2 subjects (2 %) met the criteria of thrombocytopenia prior to VPA use. Sex and age was not identified as the risk factor for developing thrombocytopenia; however, VPA dosage greater than 1000 mg/day ($p=0.01$) and plasma VPA trough level over 80 gg/ml ($p=0.03$) were claimed to be the risk factor for developing thrombocytopenia. Moreover, we found that concomitant drugs did not contribute to significant decrease of platelet count and no haemostatic problems were noted in thrombocytopenic subjects.

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Conclusion: In this study, the estimated prevalence rate of thrombocytopenia among hospitalized patients taking VPA was 20 %. Lack of platelet count in part of subjects during VPA treatment might reveal physicians had confirmed platelet counts fell in normal range in these individuals. Routine surveillance of platelet level prior to and after VPA treatment was encouraged especially in subjects with high dose VPA and high plasma VPA trough level.

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18-M

Category: Emergency Medicine / Emergency Room

Title: Impact of pharmacy services during Boston Marathon bombing

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Purpose: Massachusetts General Hospital (MGH) Pharmacy Department trains on disaster drills with the hospital disaster team. April 15th, 2013, was not a drill; the MGH Pharmacy Department was prepared. The Boston Marathon bombings put MGH in to Emergency Mode. MGH Pharmacy Department met the needs of the hospital and assisted with the care of the patients in the Emergency Department. This unfortunate event justified the use of dedicated pharmacists in the MGH Emergency Department and pharmacists on the MGH Disaster Team.

Methods: Interim Pharmacy Chief Officer, Erasmus Ray Mitrano ensured ED Pharmacists, a Certified Technician, and necessary medications were available; pharmacy staff knew he was the point of contact for any potential issues. One ED pharmacist, Nancy Balch, initially covered the Emergency Department (ED); two additional pharmacists were added. A second ED pharmacist, Ivy Ruth Andreica, started her shift and assisted; this allowed a pharmacist in both regions of the Acute ED. A pediatric-trained pharmacist, Lois Parker, stayed in contact with Ray; she would assist if a pediatric patient arrived. This pharmacist stayed out of the ED, due to the large number of staff already in the ED. A Certified Technician was dedicated to setting up emergency medication stock in the ED and restocking medications as needed. Other staff took over reviewing and approving electronic ED medication orders. All other staff remained in contact with Ray, as needed, but stayed physically away from the ED. During situations such as this, the ED is considered part of a crime scene; unnecessary staff is expected to remain away.

Results: Dedicated ED Pharmacists were physically in the emergency department prior to patient arrivals; they assisted in the bays as needed. Medications, at care stations set up by the ED, were available prior to patient arrival. The Pediatric Pharmacist did not need to come to the ED. Other pharmacists were available, if needed. Ray monitored all events and ensured medications were available; he also ensured staff was continually updated regarding pharmacy requirements. Previous training and education of staff, on potential events, ensured pharmacy provided a rapid and appropriate response.

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Conclusion: Pharmacists are vital staff during emergency events. Hospital emergency departments benefit from dedicated pharmacy staff. Hospital Disaster Drills should include pharmacy staff to ensure rapid, and appropriate, response during actual events. Pharmacy Departments should be proactive in regards to involvement on disaster teams, disaster drills, and other potentially large scale events. Pharmacy Departments require trained staff, specific individuals in charge during potential events, and knowledge regarding appropriate actions. Pharmacists, and Certified Pharmacy Technicians, make a difference during disaster situations.

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19-M

Category: General Clinical Practice

Title: Improving patient safety through a collaborative heparin project

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Purpose: Anticoagulants have been identified as one of the top five drug types associated with patient safety issues in the United States. Carilion Roanoke Memorial Hospital (CRMH), a 763 bed community teaching hospital and regional referral center, experienced a significant number of heparin medication errors, prior to 2010. A Failure Mode Effects Analysis (FMEA) was conducted, but despite changes from the FMEA and hospital-wide education, the heparin error rate remained high. A detailed internal review in 2011 revealed 45 of 53 patients (85%) had at least one observed heparin error. Seventeen errors with harm involving heparin were reported in 18 months between January 2011 and June 2012, an average of nearly one per month.

Methods: A collaborative process was developed and included recommendations from The Joint Commission (TJC) sentinel event alert on the use of anticoagulants, revised education for nursing and pharmacists, proactive pharmacist monitoring of aPTTs, and improved communication and access to information. Focus was also placed on improved communications with the laboratory and phlebotomy staff. A pilot project was conducted on three nursing units with high heparin infusion utilization. This process was eventually expanded to include nursing units with lower heparin infusion utilization to ensure the process worked in both areas. The final phase resulted in expanding to the remainder of this 28 adult inpatient unit hospital.

Results: Zero errors causing harm from heparin infusions from June 2012 through February 2014 (20 months) on units involved with this collaborative heparin project. A medication use evaluation showed appropriate dose adjustment improved from 83.8% to 93.9% and electronic medication administration record (MAR) documentation of heparin doses improved from 77.1% to 93.9% after hospital-wide implementation of this project.

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Conclusion: Lack of understanding about workflow across departments, knowledge deficits, and lack of communication between nursing, pharmacists, and laboratory were identified as major barriers. This project highlights the importance of communication between various departments when using high risk medications. Periodic interdisciplinary meetings remain important for continued process improvement.

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20-M

Category: General Clinical Practice

Title: Clinical and behavioral impact of pharmaceutical care services in community pharmacies in Puerto Rico

Primary Author: Edna Diaz; **Email:** Edna.C.Diaz@gmail.com

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Purpose: Medication Therapy Management (MTM) is an area in which pharmacists have the opportunity to provide pharmaceutical care by working directly with patients and their physicians to optimize pharmacological therapy. While it is evident that MTM services provide positive behavioral outcomes to the patients, regional studies on clinical and economic outcomes are lacking in Puerto Rico. The objective of this research is to determine the relationship between MTM practices and changes in clinical markers of disease and behavioral attitudes of Puerto Rican patients at community pharmacies.

Methods: The study will be a retrospective chart review design. From the pool of patients who participate in the MTM clinics of Farmacia Caridad in Bayamn, San Juan, and Guaynabo, a convenience sample of at least 30 patients will be selected for evaluation. For all MTM patients, the pharmacists routinely assess blood pressure and weight at each visit. Baseline laboratory values including, lipid panel and hemoglobin A1C, are also assessed for all patients at the first clinic visit and periodically thereafter as required for clinical monitoring of therapy. A trend analysis and paired t-test will be used to assess the impact of MTM interventions on blood pressure, lipids, and hemoglobin A1C with respect to baseline measurements. A p-value < 0.05 will be considered statistically significant. Adherence will be assessed by calculating medication procession ratio (MPR) for all medications filled from the initial MTM clinic visit through the end of the study period. Adherence will be defined as an MPR of 0.8 and greater and nonadherence will be defined as an MPR of less than 0.8.

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21-M

Category: General Clinical Practice

Title: Pharmacist interventions for prophylactic antibiotic use in puerperal patients undergoing cesarean section in a Mexican General Hospital.

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Purpose: To determine if prophylactic antibiotic treatment is appropriate to treat patients undergoing cesarean section at a second level General Hospital in Mexico, considering the recommendations of the Society of Obstetricians and Gynecologists of Canada , and The Mexican Clinical Practice Guidelines, according to which all women undergoing elective or emergency caesarean section should receive antibiotic prophylaxis.

Methods: A research of the prophylactic antibiotic schemes was made at different data bases like ebsco host, elsevier, cochrane y cenetec. A sampling of data was carried out in order to analyze retrospectively and prospectively electronic records of patients undergoing cesarean section at the obstetric department. The following parameters were documented : age, education, diagnosis, deed, previous cesarean, short integenesic period, premature rupture of membranes, difficulty in the progress of labor, comorbidity, use of antibiotic prophylaxis, prophylaxis before or after surgical procedure, antibiotic choice, outline the antibiotic, duration of surgery, product weight, amount of bleeding from the patient, difficulties at the surgical procedure, exposure to endogenous pathogenic flora, use of additional antibiotic, if the patients was readmitted to surgery, antibiotic therapy during their hospital stay, boot record with the antibiotic, number of doses, missed doses, dose surpluses, record post-operative care by nurses, antibiotic prescription at discharge and the scheme and written hygienic care. The results will be analyzed in order to determine if a change in antibiotic prophylaxis scheme is necessary to assure an efficient and effective attention.

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22-M

Category: General Clinical Practice

Title: Audit of the clinical practice in intensive care unit to develop a guide line for peptic ulcer prophylaxis.

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Purpose: Stress ulcerations can be shallow and cause oozing from superficial capillary beds. Deeper lesions cause massive hemorrhage or perforation. The Primary outcomes were to observe the current practice in critical care areas in HMC. And to compare the result to the current guidelines with the international critical care sitting. The secondary outcome is to reevaluate the practice guidelines for ulcer prophylaxis after setting a guideline for HMC setting.

Methods: The study was a retrospective , review from medical records of total of 237 patients admitted in Critical care units (medical, trauma, surgical) in HMC (Hamad Medical Corporation) . Medical records were reviewed by random sampling for patients in the ICU and upon transfer out of ICU or discharge from October 2012-December 2012 respectively by filling questionnaire. The inclusion criteria were all patients aged >18 years old, admitted to ICU in HMC, who stay more than 48 hrs ,patients who are mechanically ventilated and patients with coagulopathy. The exclusion criteria all patients who are not admitted to ICU, patients with history of GI bleeding or GERD, all patients admitted in women hospital or neonate ICU. Statistical analysis: Usage of SPSS software Descriptive statistics including frequencies ,percentages and significant difference between categorical groups measured by Chi-square test. Ethical consideration : The study was reviewed and approved by HMC research and ethics committee.

Results: There were 237 patients files randomly selected included in this review. The majority of patients in the study were from surgical and trauma intensive care unit age rang between >18-40 years of age . Total of 128 out of 237 patients where on different types of PPI as initial agents for prophylaxes against stress ulcer bleeding, found around six patients (2.5%) on H-2 antagonist develop GI bleeding, twenty seven patients on NSAIDS only three has GI bleeding as complication, six patients were on warfarin only one has GI bleeding (2.2%) six patients already using PPI(2.5%) develop GI bleeding , however proton pump inhibitors have become first line of therapy when used in majority of patients no bleeding has been developed . The efficacy of different PPI used in this study in all age groups retrieved no statistical difference in their protective benefit ($p=0.025$).

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Conclusion: Implementation of stress ulcer prophylaxes protocol in the intensive care units will allow decreased the inappropriate prescriptions in the ICU, adhere to best practice for patient safety. There has been a decrease in the incidence of bleeding due to stress ulceration. This most likely be attributed to early intervention of pharmacologic prophylaxis ,earlier initiation of enteral feeding. According to survey done to intensivists stress related ulcer are infrequent presentation however protocol is necessary. The incidence of clinically significant bleeding appears to be dependent on severity of illness and type of patient population. Duration of treatment still uncertain ,but usually suggestive to continue while risk factor are present ,No evidence data to warrant cessation of prophylaxis in setting of enteral nutrition if other risk factor exist.

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23-M

Category: Geriatrics

Title: Polypharmacy & Fall Risk in the Elderly: A Systematic Review

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Purpose: To assess the relationship between polypharmacy and falls in elderly. To identify if certain drug classes are correlated with a higher fall risk using The American Geriatrics Society (AGS 2012) Beers Criteria. To evaluate the roles of a pharmacist in reducing medication-related falls

Methods: Search strategy included using electronic bibliographic databases such as ScienceDirect, PUBMED, the JAMA Network and Wolters Kluwer over a 7 month period from August 2012 to February 2013. The search was supplemented with online site searches of relevant journals. Search terms included: Polypharmacy, Multiple Medications, Falls, Fall-Risk Increasing Drugs (FRIDs), Beers Criteria, Potentially Inappropriate Medications, Elderly and Geriatrics. Inclusion criteria: Articles relating to polypharmacy, FRIDs and fall risk in the elderly population were being identified. The reference lists of the previous reviews were searched to identify studies that met the inclusion criteria and were published within the last 10 years. A total of 18 articles were retrieved from the outline search. Using the AGS2 2012 Beers Criteria, medications associated with a higher fall risk were identified then matched against FRIDs selected from the outline search.

Results: Main causes of falls include Fall-Risk Increasing Drugs (FRIDs), polypharmacy and chronic diseases. Interventions to reduce falls include the use of an electronic medical record, ARMOR tool, converting major polypharmacy (8 or more drugs daily) to oligopharmacy (5 or lesser drugs daily) and having a face-to-face medication consultation conducted by a community pharmacist. ARMOR tool involves assessing, reviewing, minimizing, optimizing and reassessing medications such as beta-blockers, antidepressants, antipsychotics, psychotropic medications, pain medications, BEERS criteria medications and supplements. From the study, the most commonly identified FRIDs associated with Beers Criteria include psychotropic medications, centrally-acting medications and cardiovascular medications.

Conclusion: As falls can significantly influence an elderly patients quality of life, the literature review reinforced the need for routine medication reviews especially in patients exposed to polypharmacy. Although some studies have shown that polypharmacy correlates with a heightened fall risk in elderly, one should always consider other fall-risk factors such as the presence of FRIDs and other patient-

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related variables such as comorbidities, physiological changes with ageing, previous fall history and impaired judgement in the elderly patient. Pharmacists should be aware of the presence of a FRID when evaluating the appropriateness of drug use in elderly and recommend safer alternatives when available. Also, the withdrawal of a FRID should always be part of the multifactorial interventions done for fall risk patients.

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24-M

Category: Geriatrics

Title: Impact of pharmacist-led motivational interviewing on post-discharge antibiotic adherence in elderly patients with pneumonia

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Purpose: Not taking medications as prescribed, or medication non-adherence, is a growing concern among clinicians, payers and other key stakeholders. Specifically with antibiotics, non-adherence may result in ineffective disease state management, hospital admissions, additional costs and the emergence of antibiotic resistant bacteria. Motivational interviewing (MI) is a patient-centered communication skill set used to address negative health behaviors such as medication non-adherence and poor lifestyle. The objective of this study is to evaluate the impact of pharmacist-led MI on post-discharge antibiotic adherence in elderly patients diagnosed with pneumonia.

Methods: This is a prospective, randomized, controlled study that includes subjects greater than 65 years of age diagnosed with pneumonia who are discharged home from the hospital on at least three days of antibiotics. Subjects discharged to long-term care facilities, short-term rehabilitation or nursing homes, unable to speak English, or those with no permanent home address or telephone number will be excluded. The electronic medical record will be searched daily to identify eligible subjects. After consent is obtained, subjects will be randomized to the intervention or control group. In the control group, subjects will receive standard discharge instructions by a nurse or physician while subjects in the intervention group will also receive motivational interviewing and counseling from a pharmacist on their antibiotics. Retail pharmacies of all enrolled subjects will be contacted 24 to 48 hours post-discharge to verify antibiotic pick-up. Additionally, subjects in both groups will receive a follow-up phone call after their scheduled antibiotic completion date to evaluate adherence rates and encountered barriers. Subjects in the intervention group will also be asked a subset of questions to determine satisfaction with the MI session. This study is approved by the Yale Institutional Review Board.

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25-M

Category: Infectious Diseases

Title: The Difficulty with *Clostridium difficile*: A Retrospective Review Analyzing Appropriate Guideline-Based Diagnosis and Risk Factors for Nonresponse

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Purpose: American College of Gastroenterology guidelines stress the importance of accurate stratification of severity to ensure that mild to moderate cases of *Clostridium difficile* infections (CDI) are not over-treated and severe cases are treated aggressively. The purpose of this research is to determine the number of patients appropriately diagnosed and prescribed antibiotic therapy for a CDI. Secondly, risk factors for nonresponse to initial antibiotic treatment will be assessed. The results of this study could lead to future studies that address the potential need for implementation of a prescribing protocol for appropriately classifying severity and prescribing medications for CDIs. In addition, it has the potential to lend information identifying risk factors for treatment failure in initial antibiotic therapy.

Methods: Having obtained approval from the Baptist Health System Human Research Review Board, a retrospective chart review will be conducted at Shelby Baptist Medical Center on patients at least nineteen years of age who were diagnosed with a CDI between May 1, 2012 and May 31, 2014. Data that will be collected includes relevant patient demographics (age, race, BMI), diagnosis, initial antibiotic therapy received (name, dose, route, and frequency of administration), any changes in antibiotic therapy, past medical history, medication history (including specific prior antibiotic use, use of probiotics, proton pump inhibitors, and/or statins), patient labs (albumin, white blood cell count, temperature, and serum lactate). Descriptive statistics (e.g. mean, median, mode, and percentage) will be used to describe the collected information. The primary outcome is the number of patients appropriately diagnosed per guidelines and prescribed antibiotic therapy. Appropriate guideline-based diagnosis and therapy will be based upon the American College of Gastroenterology's 2013 Guidelines for Diagnosis, Treatment, and Prevention of *Clostridium difficile* Infections. Appropriate diagnosis and treatment will be determined by assessing the criteria outlined in the CDI severity scoring system and summary of recommended treatments table. The secondary outcome to be analyzed will be risk factors for nonresponse to initial antibiotic therapy. Possible risk factors that will be assessed include prior use of antibiotics in the past six months, use of proton pump inhibitors, use of H2 antagonists, use of statin

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therapy prior to diagnosis, presence of nasogastric tube, use of immunosuppressive medications, past medical history of diabetes mellitus, BMI, and age. Diagnosis of severity will be correlated to ACG Guidelines and risk factors will be compared to patients response.

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26-M

Category: Leadership

Title: Professional pharmacy students attitudes toward leadership and the value of a mentor

Primary Author: Trisha LaPointe; **Email:** trisha.lapointe@mcphs.edu

Purpose: The need for pharmacy leadership is critical for the continued growth of our profession and is dependent on the development of today's students as the next generation of pharmacists. Discussions on whether pharmacy students in their professional years are in need of a mentor are on the rise and if this sort of relationship can foster a student's leadership skills and interest. The association between future success of a pharmacy student and a mentor-mentee relationship is still undefined and merits further research. The purpose of this research initiative is to evaluate how pharmacy students in their professional years feel about leadership and the value they have for mentors.

Methods: The following 10 areas were identified as central to leadership development: 1) value of a mentor 2) a mentor helping a student to decide a setting of practice 3) identifying an area of specialty practice 4) decision to pursue a residency/fellowship 5) the value of mentor input on post graduate training 6) thoughts on having a mentor at this point 7) perspective of their leadership skills 8) perspective on the importance of leaders in the profession 9) can they identify a mentor at this point in their academic career 10) assessing interest in an e-mentoring program. These areas serve as the foundation of a survey that was distributed to pharmacy students in their 4th, 5th and 6th years. Students were asked via e-mail to assess each area using the following scale: strongly agree, agree, not sure, disagree and strongly disagree. IRB approval was obtained. Informed consent was obtained via anonymous submission of the survey.

Results: Over a two month collection period, 312/940 (33%) surveys were returned and tabulated. Six areas were considered strongly agree by over 90% of the students surveyed. Two areas concerning career options and post graduate training were considered agree by 92% of the students surveyed and the area of feeling as though they are a leader was considered not sure by 95%. One area was considered disagree by 96% of the students concerned the area of the students feeling as though they had a mentor at this point in their academic career. Key results showed that throughout the professional pharmacy program students felt that they do not feel prepared to take on a leadership role in pharmacy after graduation but did feel there is a need for leaders and that the role of a mentor could help foster these skills. The students saw a value in a mentor as they thought about career options and post graduate training.

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Conclusion: Leaders are needed in the profession. It is essential to development leadership skills in our students and mentors can play a role. Future consideration is to investigate where/how leadership skills are taught in a pharmacy curriculum as well as consider working with the state society to develop a mentoring program.

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27-M

Category: Leadership

Title: Evaluating interviewer characteristics in a mock interview for pharmacy practice residencies

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Additional Author(s):

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Purpose: To determine if characteristics of the interviewers in a faculty-led mock interview practice affected the interviewees preparedness for pharmacy practice residency interviews.

Methods: The institutional review board approved this study. A faculty-led mock-interview was conducted for students in their last year of pharmacy school who are applying to pharmacy practice residencies. A panel of interviewers from the College of Pharmacy was assembled to conduct the mock-interviews ranging from one to three faculty per mock-interview session. A survey was administered to the faculty who volunteered as interviewers to assess characteristics that may contribute to the success of preparing for a pharmacy practice residency interview. Mock-interview sessions lasted 60 minutes with 30 minutes of interview question practice and 30 minutes of constructive feedback. Two surveys were administered to students who have participated in the mock-interview exercise. One survey was administered before the mock-interview exercise and one after the mock-interview has been completed. Interviewer panel characteristics will be compared with student satisfaction and perception of residency interview preparedness.

Results: Twenty-nine students enrolled in the study with 72.4 percent successfully completing the mock-interview and post mock-interview survey from December 2013 to February 2014. When comparing interviewer panel characteristics to feelings of improvement in interview skills, identifying areas of improvement for real residency interview, information gained during the mock interview process or understanding of questions asked during the interview process, linear regression shows that there was no statistically significant difference. However there was a 37.5% increase in perception of preparedness (P equals 0.00148) for a residency interview after the mock interview practice session was completed. In regards to the feedback received during the mock interview as well as time allotted for the interview itself, they were comparable (P equals 0.65).

Conclusion: Participation in a residency mock interview showed an increase in perception of preparedness of the student. More studies should be done to assess if students felt participating in the

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mock interview helped them for their real interview as well as if participation allowed for more students to be successful in the American Society of Health-System Pharmacists (ASHP) Match Program.

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Professional Poster Abstracts

28-M

Category: Leadership

Title: Use of interactive technology for student education and postgraduate education opportunities through a student professional organization

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Purpose: Roseman University of Health Sciences in Henderson Nevada implements the use of technology to support and enhance student academic learning since its inception. Roseman University uses technological resources by: 1) using classroom monitors and laptop computers for interactive teaching/ learning, 2) submitting assignments and access to library/drug information resources available online, and 3) using video conferencing to interact with student pharmacists and clinical faculty located at our South Jordan, Utah campus. The American College of Clinical Pharmacy Student Network took full advantage of Roseman University's technology to host its first pharmacy fellowship forum to educate student pharmacists about postgraduate opportunities via video conferencing. This forum utilized firsthand accounts from current fellows through an educational format using direct question and answer session to encourage industry pharmacy practice.

Methods: This forum included a brief introduction and background regarding pharmacy fellowships, followed by personal experiences and responsibilities from current fellows in three different programs. Using technology, such as Skype, allows for a convenient way to communicate with guest speakers globally allowing the guest speakers to present from the comfort of their preferred location. Setting up this event can be easier than traditional on campus events by eliminating the costs of guest speakers. During this session four current fellows from Massachusetts College of Pharmacy and Health Sciences (MCPHS), one of which is a Roseman University alumni, spoke to student pharmacists via a video conference call. Each fellow gave a brief description of their fellowship position which included: Oncology Translational Medicine (OTM), Regulatory Affairs, Medical Affairs, and Global Clinical Supply.

Results: Fellowship forum attendance was a total of 39 students that included all three pharmacy student classes (69% first year students, 10% second year students, and 2% third year students). Student pharmacists who attended this forum obtained the following skills: identify various types of fellowship opportunities within the pharmaceutical industry, where to obtain information from the various

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universities partnered with industry, specific roles/responsibilities of select fellowship positions, teach/precept students as a fellow, and opportunities post fellowship. In a survey which included 79 United States colleges and schools of pharmacy, 72.2% of pharmacy schools reported the use of teleconferencing as a learning tool. Alongside these colleges of pharmacy, Roseman University has joined the progressive movement in utilizing interactive technology at their fellowship forum to bridge the distance between interested students and MCPHS fellows.

Conclusion: Roseman University recognizes the benefits of interactive technology in advancing pharmacy education and the profession of pharmacy. Although interactive technology does not replace the importance of clinical faculty and professors, it is a practical resource to supplement the learning process. In a world where technology is advancing each day, it is important that student pharmacists are not only aware of available technology, but also gain skills in learning how to utilize technology to advance their educational experience. It is crucial to recognize the pivotal role that interactive technology has in colleges of pharmacy, but also to recognize its potential role in advancing the pharmacy profession through outreach via nontraditional educational means.

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30-M

Category: Oncology

Title: Comparison of rash in capped and uncapped doses of cetuximab

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Jose R. Murillo

Purpose: In clinical studies of cetuximab, an epidermal growth factor receptor (EGFR) inhibitor, high acneiform rash incidence (approximately 80%) has been reported. When a patients body surface area (BSA) is greater than 2.0 m², the dose has been capped at BSA of 2.0 m² in some clinical practice. The purpose of this study is to identify if there is any difference in rash incidence and severity between capped and uncapped dose groups.

Methods: The study has been submitted and approved by the Institutional Review Board at Houston Methodist Hospital. The electronic medical record system and/or paper charts have been used to identify patients with a BSA of 2.0 m² or greater who have received cetuximab at Houston Methodist Hospital between July 2005 and November 2013. Patients who are younger than 18 years of age or have any concurrent use of other EGFR inhibitor(s) or agents that could affect EGFR have been excluded. The following data has been collected: patient's gender, ethnicity, height, weight, BSA used for dosing, allergies, locations, cancer diagnosis, co-morbidities, loading and/or maintenance doses, pre-medications, co-administering medications, rash pre-treatment and post-treatment regimens, rash occurrence and the most serious rash grade. Provider documentation will be reviewed to determine if the patient has developed cetuximab-induced acneiform rash and the grade of the most serious rash, if available, or determined as per standard acneiform rash grading scale. All data is recorded without patient identifiers and maintained confidentially. The rash incidence and severity between capped and uncapped dose groups will be compared.

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31-M

Category: Oncology

Title: Evaluation of pain assessment practices in cancer patients admitted to the oncology floor

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Purpose: Pain is one of the most feared symptoms by cancer patients. Poor pain control negatively impacts patients quality of life, family interactions, psychological and functional health. There is growing evidence that links adequate pain control to survival. Undertreatment of cancer pain is commonly reported despite the availability of effective therapies. Implementation of pain management guidelines remains a major problem in clinical practice with pain assessment identified as a main barrier. The purpose of this study was to evaluate pain assessment practices in patients with solid tumors admitted to the oncology floor who received parenteral opioids.

Methods: The institutional review board approved this retrospective chart review. Patients with solid tumors admitted to the oncology floor between June 1 and December 31, 2013 who received parenteral opioids were included in the analysis. Compliance with NCCN guidelines for cancer pain assessment practices was evaluated. Documentation of pain intensity, characteristics, management goal, and reassessment was measured as part of pain assessment practices. In addition, ongoing patient care upon discharge was assessed. Pain score at discharge was compared to patients documented goal of pain comfort during hospital stay. In addition, the presence of a scheduled bowel regimen and breakthrough analgesics in discharge medication lists for patients discharged on a scheduled opioid regimen was reported as part of ongoing patient care upon discharge.

Results: Ninety nine patients were included in the analysis. Evaluation of pain assessment practices showed 87% compliance with pain intensity documentation. Pain characteristics were reported in 69% of the patients upon pain onset and pain management goal was documented in 93% of patients during hospital stay. Pain reassessment documentation within one hour of parenteral opioid dose was achieved 43% of the time. Assessment of ongoing patient care upon discharge showed that 87% of patients met their pain management goal upon discharge. In patients discharged on scheduled opioids, 56% and 88% had a scheduled bowel regimen and breakthrough analgesics, respectively, in their discharge medication list.

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Conclusion: Improvement in pain control strategies should be considered a priority in daily practice. Our analysis showed that compliance with pain management guidelines remains problematic. Pain reassessment has been identified as a main area for improvement. Future efforts should focus on a multidisciplinary collaboration to identify barriers and apply quality improvement practices aiming at improving pain assessment, reassessment practices and patient discharge support.

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32-M

Category: Oncology

Title: High-dose rapid-infusion rituximab: evaluation of the safety profile

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Jayde Bednarik

Purpose: Rituximab is a chimeric anti-CD20 monoclonal antibody often associated with infusion reactions. Multiple reviews have documented the safety of rapid infusion at the standard 375 mg/m² dose. Increasing data has been published showing the benefit of higher dose rituximab in hematologic CD20+ malignancies. Since January 1, 2012 our institution implemented a rapid infusion protocol for these higher doses as described below. Our aim is to review the adverse event rate, primarily infusion-related reactions, associated with rapid infusion of rituximab administered at doses of 500mg/m² and 750mg/m² for oncologic indications at UMass Memorial Medical Center.

Methods: All patients between January 1, 2012 and September 30, 2013, treated with rituximab at doses of 500mg/m² and 750mg/m² were evaluated and matched to patients treated with rituximab at doses of 375mg/m² for oncologic indications. All patients received initial infusion with the traditional administration rate, starting at 50 mL/hr, increased by 50 ml/hr every 30 minutes to a maximum rate of 400 mL/hr using a 1 mg/mL concentration. Subsequent infusions were infused at a more rapid rate contingent upon the patients tolerance of the initial infusion, starting at 100 mL/hr for 30 minutes and increased to 200 mL/hr for the remaining volume. Doses of rituximab at 375mg/m², 500mg/m², and 750mg/m² were dispensed in 0.9% sodium chloride for final volumes of 250 mL, 350 mL, and 500 mL and infused over 1 hour, 1.75 hours, and 2.5 hours, respectively. Data collected included age, BSA, oncologic indication, stage, performance status at time of infusion, premedications, history of cardiovascular disease, actual lymphocyte count, total dose, cycle number, rapid versus traditional rate, and previous exposure to rituximab. Infusion reactions were rated using the NCI Terminology Criteria for Adverse Events.

Results: Over the 21 month period, 172 patients were treated with rituximab for oncologic purposes. 22 patients receiving 138 high dose infusions have been identified. Preliminary analysis of the data did not show an increased incidence in grade 3 or 4 infusion reactions with higher doses of rituximab, rapidly infused. Finalized data will be presented at the meeting.

Conclusion: Rituximab can be safely administered at higher doses with a rapid infusion after a patient has tolerated an initial infusion at the traditional administration rate.

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33-M

Category: Pharmacokinetics

Title: Evaluation of appropriateness of treatment with concomitant administration of valproic acid and carbapenem antibiotics

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Purpose: Valproic acid, the first-line treatment of antiepileptic drugs, is effective for all types of seizure but has a narrow therapeutic range that needs TDM(therapeutic drug monitoring) and cautions when used in combination with other drugs. In particular, the concomitant administration of carbapenem antibiotics was contraindicated by the Korea Food and Drug Administration(KFDA) because it may reduce serum valproic acid concentration to subtherapeutic levels, resulting in the loss of seizure control. In this study, we investigated the changes in serum valproic acid concentration when concomitantly administered with carbapenem antibiotics, and examined the proper follow-up treatments and development of seizures.

Methods: This study was performed retrospectively on inpatients who had received valproic acid and carbapenem antibiotics(meropenem and imipenem) from January 2012 to October 2013. We used the Electronic Medical Records(EMR) system in the Veterans Health Service Medical Center.

Results: During the 22-month period, the concentration of the serum valproic acid had been measured in 104 of the 147 patients receiving it and a carbapenem antibiotic at the same time. Valproic acid concentrations decreased in all of the 104 patients, furthermore, 92 (88.5 percent) of them had subtherapeutic levels (50mcg/mL). Seizures occurred in three of the 104 patients whose valproic acid concentrations were 4.46mcg/mL, 13.21mcg/mL, and 20.59mcg/mL, respectively. As result of the follow-up treatment for having a reduced concentration of serum valproic acid in the 104 patients, the effect was discontinued through alternation the patients antibiotics (n=7); alternation them to another antiepileptics (n=42); increasing their valproic acid dose (n=33); without altering the two drugs, adding another antiepileptics (n=13); or despite the reduction of serum valproic acid concentration, no follow-up treatment was taken (n=9).

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Conclusion: In this study, we found that concomitant administration of valproic acid and carbapenem antibiotics significantly reduced serum valproic acid concentrations in all patients. Significantly dropped subtherapeutic levels caused seizures in three patients. Therefore, more caution is needed in concomitant administration. If coadministration is unavoidable, pharmacists should monitor the therapeutic range of valproic acid frequently to prevent seizures.

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34-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Community pharmacist perception and attitude toward ethical issues at community pharmacy, saudi arabia

Primary Author: Mohamed Nasser Al-Arifi; **Email:** malarifi@ksu.edu.sa

Purpose: The purpose of this study is to identify the community pharmacist perceptions and attitudes towards ethical issues at community pharmacy setting in Saudi Arabia

Methods: A cross-sectional, descriptive, and qualitative survey of community pharmacists, the survey questions were pre-tested by a pharmacist with extensive experience in ethical issues. Based on the result of a pilot study the questionnaire used with some modifications and the final questionnaire was sent to the participants through handling by face to face, mail or E-mail.

Results: 45.7% often discuss ethical issues with their patients, while only 2.1% never discuss it. 40.6% record ethical concern often where only 1.9% of them never did so. 31.5% reported that patients who initiate ethical issue discussion while 28.3% the pharmacists who initiate the discussion. Barriers that limit discussing ethical issues with their patients were lack of time due to other obligation assigned to the community pharmacist (69.2%), lack of reliable resources (10.7%), not interested in subject (10.1%), lack of knowledge one ethical issues (4.8%), another reasons (5.3%). Recourses are books (37.7%), internet web sites (31.1%), and brochures (26.8%). Only minority of respondents had access to computer databases (15.8%) and other resources (1.3%). Most perceived ethical problems: asked for hormonal contraception, dispensing a drug for unreported indication (69.2%), dispensing dose of medicine for a child that is outside (SNF) limits (68.9%), unwanted professional behavior about controlled drugs (66.6%), a colleague insisted on unethical behavior (65.0%), a colleague has done an unethical for the first time (64.7%), thought of abused child (63.3%) prescribing on private scripts for suspected medications of possible abuse (60.7%) and terminally ill patient asks for a diagnosis or prognosis (52.9%).

Conclusion: The findings of this study assured the need of Saudi health authorities to implement a code of ethics for pharmacy practicing to cover all aspects of ethical issues.

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35-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Intravenous Ibuprofen Medication Use Evaluation in a Community Hospital

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Purpose: Ibuprofen as an oral analgesic agent was approved in the United States in 1974. The safety profile and extensive experience demonstrated via phase four trials, resulted it is approval as an over the counter product. Intravenous ibuprofen has recently been approved for use in the US. It can be used alone or in combination with narcotics, to limit narcotic usage, and their associated side effects. This agent was approved for addition to our formulary. We describe findings from experience in an obstetrics population at one of our community hospitals. This study was approved by our Institutional Review Board.

Methods: This was a retrospective study carried between October and November of 2013, in a study population of 20 female patients at our obstetrics unit, with the following diagnoses: cesarean section (10 patients), contractions (3 patients), labor induction (4 patients), labor pain (1 patient), pink color leaking fluid (1 patient), and spontaneous rupture of membranes (1 patient). Demographic data, as well as length of stay, dosage, number of doses used, concurrent analgesic therapy, and pre and post treatment pain assessment scores were collected. The universal pain assessment tool with a scale of 0 to 10, with 0 being no pain, and 10 the worst pain possible was used. The patients were evaluated for any significant adverse effects.

Results: The mean age for these patients was 29.65, with a standard deviation of plus or minus 5.34, and 95 percent confidence level of 2.5 years. Mean weight was 202.2, with standard deviation of plus or minus 38.92, and 95 percent confidence level of 18.21 pounds. All patients received 800 mg intravenous ibuprofen, with mean number of doses of 2.75, standard deviation of plus or minus 0.64, and 95 percent confidence level of 0.29 doses. Duration of therapy was 24 hours. A total of 377 analgesic doses were administered. The most frequently used analgesics were: oral acetaminophen-hydrocodone (36%), oral ibuprofen (23.6%), intravenous narcotics (22.2%), and intravenous ibuprofen (14.5%). Evaluable pre and post pain assessment scores were available in 18 out of the 20 patients followed. Initial pain assessment scores ranged from 3 to 9, and post treatment pain assessment scores ranged from 0 to 4. The mean initial pain assessment score was 5.88, with standard deviation of plus or minus 0.50, and 95 percent

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confidence level of 1.0. The mean post pain assessment score was 0.61, with standard deviation of plus or minus 1.2, and 95 percent confidence level of 0.61. No significant adverse events were observed.

Conclusion: These data demonstrate that intravenous ibuprofen can be used in combination with narcotic analgesics to limit the use of narcotics and their associated side effects. Excellent post intravenous ibuprofen pain scores were observed. No significant adverse drug events were reported.

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36-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Adherence to recommendations for hepatitis B, pneumococcal, and influenza vaccination in patients with diabetes

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Additional Author(s):

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Purpose: The Advisory Committee on Immunization Practices (ACIP) is a group of medical and public health experts that develop recommendations on the use of vaccines in the United States. For all persons with diabetes ACIP recommends annual influenza vaccination, at least one lifetime 23-valent pneumococcal polysaccharide (PPSV23) vaccination, and a full 3 dose hepatitis B vaccine series to persons with diabetes age 19 to 59. The purpose of this study was to assess adherence with ACIP recommendations and evaluate predictors of immunization with the influenza, pneumococcal, and hepatitis B vaccines in patients with diabetes at an academic community hospital.

Methods: This was a cross-sectional analysis of data extracted from the electronic medical record of patients admitted to the medical teaching service during the 5 month study period beginning in September, 2013. Signed informed consent was waived, and the Institutional Review Board approved this study. Patients included for assessment were at least 19 years of age, had a documented diagnosis of diabetes present upon admission, and confirmed outpatient diabetes medication use. Adherence to ACIP recommendations for each vaccine was assessed considering available information on precautions or contraindications to use. Patient demographic, co-morbid disease, and diabetes-related variables were evaluated as potential predictors of adherence. The bivariate odds of adherence were assessed for each potential predictor and vaccine combination. Odds ratios are presented with 95 percent confidence intervals. For continuous variables, the data are expressed as means with accompanying P values. Rates of adherence to immunization recommendations for each vaccine were compared with the most recent national coverage goals and estimates.

Results: A total of 364 charts were reviewed and 100 patients with diabetes mellitus were evaluated for adherence with ACIP recommendations. Of 39 patients qualified to receive the hepatitis B vaccine, none had initiated the vaccine series. The rate of adherence was 41 percent for the influenza vaccine and 37 percent for PPSV23. Patients that were adherent with PPSV23 had a larger mean number of co-morbid diseases (1.92 versus 1.27; P less than 0.01). Patients adherent with either the influenza vaccine or PPSV23 were more likely to also be adherent with the other vaccine (odds ratio 1.97, 95 percent CI 0.86 to 4.50). The 41 percent influenza vaccine coverage in this study was less than the 47 percent rate in

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high risk individuals age 18 to 64 and the 66 percent rate for elderly adults estimated nationally for 2012 to 2013. Coverage with PPSV23 of 37 percent in this study was in between the 2011 national estimates of 62 percent for elderly adults and 20 percent for high risk adults 18 to 64. The absence of any patients that had received hepatitis B vaccination in this study is inconsistent with the 27 percent coverage estimate for patients with diabetes in 2011.

Conclusion: As part of the Healthy People 2020 initiative, the United States Department of Health and Human Services designated goal vaccine coverage rates for high risk adults ages 18 to 64 of 90 percent annually for the influenza vaccine and 60 percent lifetime coverage with PPSV23. Immunization rates in patients with diabetes nationally and in this study are below target levels with the influenza vaccine and PPSV23. Immunization against hepatitis B has not been adequately implemented since the 2011 ACIP recommendation to vaccinate this population. Pharmacists can play a role in improving adherence to vaccination recommendations through education and/or vaccine administration.

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37-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Comparison of usage and effectiveness between methoxy polyethylene glycol epoetin beta and darbepoetin alfa with hemodialysis patients

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Purpose: In patients with chronic kidney disease (CKD), anemia is caused by decreased erythropoietin production relative to hemoglobin(Hb) levels. Traditional erythropoiesis stimulating agent(ESA) such as darbepoetin alfa(DA) has short half-life and requires frequent administration, dose changes, and close monitoring of Hb concentration to maintain target Hb levels. Methoxy polyethylene glycol epoetin beta (MPG-EPO) which has a long half-life (approximately 130 hours) is developed to provide stable control of Hb levels at extended administration intervals. The purpose of this study was to compare the patterns of use, efficiency of therapy and cost with CKD patients undergoing hemodialysis in Korea.

Methods: The institutional review board approved this retrospective study. Patients over the age of 18 who were treated anemia by MPG-EPO (n equals 13) or DA (n equals 9) for 16 weeks were subjects of this study. Patients whose Hb concentration is less than 11 gram per deciliter before starting drug administration were enrolled. Electronic medical record system was used to examine administration frequency, Hb response rate, achievement of target Hb, drug costs. Response rate was defined as the proportion of patients who were examined elevated concentrations above 1.0 gram per deciliter from baseline. Achievement of Hb was based on National kidney foundation kidney disease outcome quality initiative (NKF-K/DOQI) guideline in 2007 (target Hb concentration equals from 11 to 12 gram per deciliter) and Korea national health insurance criteria and assessemnt services (applicable insurance Hb concentration equals from 10 to 11 gram per deciliter). Drug costs were based on drug insurance. A statistical analysis of the study in the case of categorical data use Fisher's exact test. The number of continuous data which can not be assumed normality was analyzed by Mann-Whitney test.

Results: No significant differences were observed in baseline parameters between groups. The median difference of Administration frequency was once in 4 weeks with MPG-EPO group and 3 times in 4 weeks with DA group. Hb response rate was 61.5 percent in MPG-EPO at the time of 16 weeks. It was not significantly different from 66.7 percent in DA (P equals 1.000). There was no statistically significant difference in achievement of target Hb based on NKF-K/DOQI guideline (30.8 percent with MPG-EPO, 33.3 percent with DA, P equals 1.000) and based on Korea national health insurance criteria (61.5 percent with MPG-EPO, 22.2 percent with DA, P equals 0.099). The drug cost for MPG-EPO was little higher than DA. However, there was no statistically significant difference (P equals 0.164).

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Conclusion: Use of MPG-EPO is as effective and safe as DA managing renal anemia in hemodialysis patients. MPG-EPO's extended administration interval improve patient's compliance and enable effective anemia treatment. The clinical significance of this effect must be determined in larger, long term trials.

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38-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Analysis of the Intravenous (IV) Compounding Errors in a Pediatric Hospital

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Purpose: An IV workflow management system, DoseEdge by Baxter, was implemented in the sample hospital of Cincinnati Childrens Hospital Medical Center (CCHMC), Cincinnati, Ohio in January, 2013. The DoseEdge system utilizes barcode scanning and image recording technologies to detect and document the errors in the IV compounding process, and is believed to be reliable in detecting and documenting the errors. The objective of this study was to determine the IV compounding error rate and the associated variables based on a period of the DoseEdge data. This study is important to determine effective strategies to eliminate IV dispensing errors.

Methods: Three months data (October 15, 2013 to January 15, 2014) of IV compounding data from the Epic system, and IV dispensing error data from the DoseEdge system of CCHMC was utilized in the analysis. Both sets of data were cleaned by eliminating duplicate records, and linked by order ID. A descriptive analysis was conducted to quantify the error rates by predefined categories: (1) Incorrect Drug a drug other than the one prescribed was selected, (2) Incorrect Diluent the base solution used was different from the one prescribed, (3) Expired Product - the premixed products would expire before the administration time, (4) Wrong Volume a discrepancy between the dispensed and prescribed volume, (5) Dose Damaged physical imperfection including broken syringes, damaged labels, etc., (6) Dose Lost - dose or label cannot be found, and (7) Others other than the above including dose placed in wrong type of container, short cut detected, etc. The analysis also included: error rates of Sound Alike and Look Alike Drugs (SALADs), error rate by weekday and weekend, different shifts, workload, staff (pharmacist and technician). The related workload was used in determining the error rates. SAS 9.4 and Excel software were used in the data analysis.

Results: The total IV doses dispensed by the DoseEdge system during the study period were 113,617. There were 682 (0.6% of all IV dose dispensed) IV dispensing errors, including 542 (79%) caught in the preparation steps by the DoseEdge system, and 140 (21%) caught by the pharmacist during inspection. The errors caught during the preparation steps included Incorrect Drug 254 (37.2% of all errors),

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Incorrect Diluent 249 (36.5%), and Product Expired 39 (5.7%). The errors caught by pharmacists included Wrong Volume 99 (14.5%), Dose Damaged 16 (2.3%), Expired Product 9 (1.3%), and Others 14 (2%). Among the Incorrect Drug Errors, 92 (13.5%) were Sound Alike Look Alike drugs (SALADs). During the week, most errors occurred on Monday (17.7%), Tuesday had the least errors (11.8%). In the three shifts, the shifts between 22:00-7:00 had the lowest error rate (0.38% over 50,785 doses prepared), the 7:00-15:00 shift (0.78% over 33,640 doses) and the 15:00-22:00 shift (0.77% over 29,130 doses). Further regression analysis to determine the relationship between these variables and IV compounding errors and their clinical significance is planned.

Conclusion: The results indicate Incorrect Drug, Incorrect Diluent, and Expired Product were the main sources of IV compounding errors (79.4% of all errors). The DoseEdge system can be utilized to prevent 80% of IV dispensing errors, especially incorrect drug and diluent. Pharmacists can detect an additional 20% of errors, especially wrong volume. SALADs were a major factor in the Incorrect Drug errors. The IV compounding error rates were varied by weekday and weekend, and different shifts. This study provides a scientific foundation for developing effective strategies to reduce IV dispensing errors which should be evaluated by other hospitals.

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39-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Clinical efficacy of a levothyroxine suppository in patients with hypothyroidism

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Purpose: Synthetic levothyroxine (LT4) is widely used for the treatment of hypothyroidism. However, if patients receiving long-term medication with LT4 undergo surgery, they are unable to take oral medication for several days. Rectal administration using suppositories is an alternative for patients where oral administration is not feasible. This study aimed to elucidate the clinical efficacy of a LT4 suppository, thus, we examined the relationship between dose and the levels of free T4 (FT4) in patients with hypothyroidism treated with LT4 tablets and suppositories.

Methods: LT4 tablets were ground and mixed with melted suppository bases: Witepsol H-15 and Witepsol E-73 (1:1). The resulting mixture was then poured into plastic molds (75 g of LT4/1.35 g of suppository) to form the suppository. To evaluate the clinical efficacy of LT4 suppositories, we enrolled six Japanese patients with hypothyroidism (male/female = 2/4; age, 68.2 plus or minus 13.5 years). They were treated with oral thyroid hormone replacement therapy using LT4 tablets. The individual daily dose of tablets or suppositories was selected by the physician according to each patient's clinical requirements. The daily dose of LT4 and the serum levels of FT4, free triiodothyronine (FT3), and thyroid-stimulating hormone (TSH) during administration of the tablets and suppositories were analyzed from medical records. Data during suppository administration were obtained between days 6 to 14 after the treatment was switched from tablet to suppository, i.e., when FT4 levels were expected to reach a steady-state. Data during tablet administration were obtained on the day nearest to when the tablet was changed to the suppository. All patients gave written informed consent, and the study protocol was approved by the Ethics Committee of Kameda Medical Center.

Results: The daily dose of LT4 was 117 plus or minus 54 g for tablets and 161 plus or minus 89 g for suppositories, and the dose of suppository was 1.43-fold higher than that of the tablet ($P = 0.033$). No adverse events were experienced with either treatment, and the administration of tablets and suppositories were both well tolerated. The FT4 level during the administration of suppositories was significantly lower than that with tablets (0.657 plus or minus 0.183 ng/dL vs. 1.25 plus or minus 0.51

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ng/dL, respectively, $P = 0.034$). Similarly, the FT3 level significantly decreased following the change from tablet to suppository (1.94 plus or minus 0.83 pg/mL vs. 0.657 plus or minus 0.183 pg/mL, respectively, $P = 0.009$). The TSH levels during the administration of tablets and suppositories were 16.6 plus or minus 33.9 IU/mL and 22.7 plus or minus 36.6 IU/mL, respectively, and no significant difference was observed between these levels. To compare the clinical efficacy between tablets and suppositories, the ratios between FT4 levels and dose were calculated. Significantly, the FT4/dose ratio for the suppository was 44 percent lower than that for the tablet.

Conclusion: This study suggested that the FT4/dose ratio for the suppository was 56 percent of that for the tablet, and that the dose of LT4 suppositories would likely need to be 1.8 times higher than that of tablets to maintain T4 levels in patients with hypothyroidism. Thus, the administration of LT4 suppositories may be a viable alternative to oral medication in clinical practice.

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40-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Effects on the palatability of the dry-syrup formulation of fexofenadine when taken in combination with food and beverages

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Purpose: The taste of medicines can significantly affect patient compliance. In pediatric patients taking powder medicines, there are instances where they cannot take them due to their taste. Patients' parents and health care professionals, including pharmacists, often combine medicines with food or beverages to make them easier for pediatric patients to take, as this can reduce their unpleasant taste. However, there have been few quantitative studies on the improvements in the acceptance of medicines when combined with food and beverages. This study aimed to clarify the effects of food and beverages on the palatability of the dry-syrup formulation of fexofenadine (Fex-DS).

Methods: A taste sensory test was performed on 13 healthy adult subjects (age, 22.6 plus or minus 1.1 years; mean plus or minus standard deviation [SD]). A randomized, crossover design was used to assess sensations while taking Fex-DS (fexofenadine hydrochloride dry syrup 6 % [TOWA], Towa Pharmaceutical. Co. Ltd., Osaka, Japan) with four groups of beverages (water, green tea, milk cocoa [MC], and sports drinks [SpD]), followed by yogurt (YO) and ice cream (IC). The subjects were evaluated while holding Fex-DS in their mouths mixed with water, green tea, MC, SpD, YO, or IC for 30 sec (the first assessment). They were evaluated again (the second assessment) 30 seconds after spitting the mixture out of the oral cavity. Palatability was evaluated using a visual analog scale (VAS) with a maximum of 100 mm (for bitterness, sweetness, grittiness, and overall palatability). In addition, subjects used the VAS to assess how highly they would recommend each combination for use in pediatric patients. All subjects gave written informed consent, and the study protocol was approved by the Ethics Committee of the University of Shizuoka, Japan.

Results: The bitterness experienced when taking Fex-DS with food and beverages was evaluated as moderate, measuring 42 mm on the VAS and measuring 45 mm 30 seconds after spitting the mixture out. The bitterness of Fex-DS was significantly reduced when taken in combination with SpD, YO, and IC; YO was particularly effective in reducing the bitterness sensation (by 8.2 mm). In the assessment performed after the subjects spat the mixture out, the bitterness-reducing effect of YO was maintained

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(14.6 mm). The sweetness experienced when taking Fex-DS with food and beverages was significantly increased when taken in combination with SpD, MC, and IC. The score on the VAS for the grittiness of Fex-DS taken alone was relatively low, at 30 mm. Overall palatability experienced taking Fex-DS with all the tested food and beverages was increased compared to when it was taken with water alone; this was particularly significant when taken in combination with IC and YO. Furthermore, the recommendation for use in pediatric patients was significantly higher with IC and YO; especially YO, which was the most highly recommended, measuring 78 mm on the VAS.

Conclusion: In this study, we investigated taste in order to reveal food and beverages that when taken in combination with Fex-DS could improve the sensations experienced when taking the drug. According to the results, no food or beverages deteriorated the sensations experienced. Furthermore, IC and YO were particularly recommended for pediatric patients.

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41-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Impact of insulin delivered by pen versus vial/syringe on clinical and cost outcomes among Medicare Part D beneficiaries

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Purpose: Insulin devices may play an important role in the effectiveness of type 2 diabetes mellitus (T2DM) therapy, especially among elderly patients with visual/dexterity problems. The purpose of this study was to describe clinical and health-economic outcomes, including adherence and persistence, among elderly T2DM patients with Medicare Part D coverage who initiated insulin glargine using either a pen device or vial and syringe.

Methods: This retrospective study used Humanas linked medical and pharmacy claims data from insulin-naïve T2DM patients (aged 65 years or older) with continuous Medicare Part D enrollment 1 year before and after insulin glargine initiation by pen or vial/syringe (index date between January 1, 2008 and December 31, 2011). Study endpoints included: first-year HbA1c reduction; hypoglycemia incidence and event rate per patient per year; percentage of patients persistent with treatment and duration of persistence; and healthcare costs in USD. Persistence was defined as the expected time of medication coverage and the persistency gap was defined as the 90th percentile of time between the first and second pharmacy claims of index insulin among patients with at least 1 refill of index insulin. The 90th percentile calculation was then applied to each quantity supply observed during the follow-up period. Propensity score matching (PSM) was used to control for differences in baseline characteristics between cohorts.

Results: Among 108,915 identified patients with pen or vial/syringe prescriptions, 4,876 met all inclusion criteria and 3,202 were matched (1,601 per cohort). Baseline patient characteristics were well balanced post-PSM: mean age was 74 years, 50 percent were men, mean comorbidity index was 3.8, and mean HbA1c was 8.6 percent. After 1 year, more pen (58.5 percent) than vial/syringe initiators (50.8 percent) were persistent with treatment (P less than 0.0001) and patients initiating with a pen were persistent for longer (mean 307.5 days) versus vial/syringe initiators (mean 280.7 days) (P less than 0.0001). Patients initiating with a pen had greater HbA1c lowering from baseline versus vial/syringe patients (minus 0.81 percent vs minus 0.61 percent; P equals 0.0102). The mean HbA1c values at 1-year

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follow-up were not significantly different between pen (7.82 percent) and vial/syringe initiators (7.92 percent) (P equals 0.0731). Multivariate analyses among the subgroup with available HbA1c results demonstrated a 0.13 percent greater HbA1c decrease with pen (P equals 0.0193). Hypoglycemia incidence proportions were similar among pen and vial/syringe initiators (11.6 percent vs 11.9 percent of patients, respectively; P equals 0.7853). Pen users had a mean 0.29 hypoglycemia events/patient/year compared with 0.49 hypoglycemia events/patient/year among vial/syringe users (P equals 0.0265). Mean total annual diabetes-related prescription costs were USD 1,680 among patients using a pen device and USD 1,444 among vial/syringe users (P less than 0.0001). Total annual diabetes-related costs were not significantly different between pen (USD 7,595) and vial/syringe users (USD 7,123) (P equals 0.2499).

Conclusion: Our study describes how older T2DM patients with Medicare Part D coverage who initiated insulin therapy with a pen device were more persistent with treatment and for a longer duration versus patients using vial/syringe. In addition, patients who used a pen device had greater HbA1c lowering from baseline than vial/syringe users and had lower number of hypoglycemia events. Prescription costs for use of a pen device were higher than for vial/syringe, but had no significant impact on the total annual diabetes-related costs. Our study suggests that initiating insulin with a pen might result in improved treatment persistence and better glycemic control than vial/syringe in elderly T2DM patients, with a reduced total number of hypoglycemic events and comparable diabetes-related costs.

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42-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Healthcare costs among newly diagnosed non-valvular atrial fibrillation patients newly initiating treatment with dabigatran or warfarin

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Purpose: Dabigatran, a novel oral anticoagulant, has been shown to significantly reduce the risk of ischemic stroke in patients with non-valvular atrial fibrillation (NVAF) compared to warfarin in a clinical trial setting. Evaluation of healthcare costs in a real-world setting may provide insight into the value of dabigatran. The purpose of this study was to assess and compare the all-cause healthcare costs in NVAF patients who are newly initiating dabigatran or warfarin.

Methods: The Humana administrative claims database was utilized to identify newly diagnosed NVAF patients that were newly initiating dabigatran or warfarin treatment between 1/1/2011 and 12/31/2011. Patients were required to have both medical and pharmacy Medicare benefits and be 18-89 years of age at index date. The index date was defined as the date of first dabigatran or warfarin fill within 3 months of first observed NVAF diagnosis. Eligible patients had 12-months pre-index continuous enrollment and were followed until discontinuation, switch, disenrollment, death or end of the 12-month observation period, whichever occurred first. Dabigatran and warfarin patients were matched using propensity scores. Discontinuation was defined as a gap (without medication) of >30 days after the end date of the last fill; switch was defined as a fill for a non-index oral anticoagulant (OAC) during the follow-up period. Total medical costs by place of service (hospitalization, emergency room (ER), physician office visit and other outpatient visit), total pharmacy costs and total costs (medical + pharmacy) per patient per month (PPPM) were estimated and compared using the Wilcoxon rank-sum test. Unadjusted and adjusted (controlling for age, gender, race, CHADS2 score and HEMORR2HAGES score) p-values were derived using a generalized linear model (GLM) with log-link function and gamma distribution.

Results: The analysis included 1,110 dabigatran and 1,110 warfarin matched patients. For both groups, mean age was 75 years, 51% were male, and 90% were white. Average follow-up time was 0.56 and 0.62 person years for dabigatran and warfarin, respectively. Mean pharmacy costs were greater among

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dabigatran users (\$506 PPPM) compared to warfarin users (\$247 PPPM), $p < 0.001$. Mean total medical costs were lower for dabigatran patients (\$1,834 PPPM) versus warfarin patients (\$1,877 PPPM), $p = 0.007$. By place of service, mean all-cause hospitalization costs showed the greatest cost savings for dabigatran users (\$1,080 PPPM) compared to warfarin users (\$1,151 PPPM), $p = 0.016$. All-cause ER visits were also less costly among dabigatran users (mean \$72 PPPM) compared to warfarin users (mean \$81 PPPM), $p = 0.0008$. Mean total healthcare costs were higher for dabigatran users versus warfarin users (\$2,341 PPPM vs. \$2,123 PPPM, $p < 0.0001$ using Wilcoxon rank-sum test) driven mainly by higher pharmacy costs; however, when examined utilizing a GLM approach there were no statistically significant differences in costs (unadjusted GLM coefficient for dabigatran vs. warfarin 1.068, $p = 0.1626$; adjusted GLM coefficient for dabigatran vs. warfarin 1.075, $p = 0.1170$).

Conclusion: Mean total costs (medical + pharmacy) were higher with dabigatran versus warfarin prior to adjustment using GLM. After adjustment, mean total costs were similar between dabigatran and warfarin cohorts. Medical cost savings in dabigatran patients may be a result of lower hospitalization and ER-related costs.

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43-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: CLINICAL AND ECONOMIC CHARACTERISTICS OF EMERGENCY DEPARTMENT VISITS DUE TO ACETAMINOPHEN TOXICITY IN THE UNITED STATES

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Purpose: To assess the relationship between comorbid conditions and outcomes of charges, lengths of stay, required use of invasive mechanical ventilation, and discharge status among cases of acetaminophen toxicity cases presenting to emergency departments within the United States from 2006 to 2010.

Methods: This retrospective investigation utilized nationally-representative emergency department data from the Agency for Healthcare Research and Quality (AHRQ) Health Care Utilization Project (H-CUP) for the five years spanning 2006 to 2010. The inclusion criteria included any diagnosis on record of acetaminophen toxicity based upon the International Classification of Disease, 9th edition, Clinical Manifestations (ICD-9-CM) codes 965.4, E850.4, E935.4, E950.0, and E980.0. Discharge status was evaluated as treat-and-release, inpatient admission, or death via a multinomial logit model after controlling for demographics (sex, income quartile, age category), hospital characteristics (urban/rural, teaching status, geographic region), payer, year, and 30 Elixhauser comorbidities to reflect case-mix severity. Multivariate gamma, negative binomial, and logistic regressions were used to evaluate outcomes of charges, length of stay, and use of invasive mechanical ventilation, respectively. All analyses were conducted using SAS 9.2 or STATA SE 12.1 with an alpha level of 0.05 for statistical significance and Taylor-series standard error calculations for the complex sampling design employed.

Results: Overall, 872,974 ED visits were associated with acetaminophen toxicity in the US from 2006-2010, with 44.2% resulting in a direct inpatient admission, 38.4% treated and released from the ED, 14.9% transferred to another facility, and 0.8% resulting in death. A majority of cases were female (61.4%). The mean age across all cases was 33.518.2 years, with a tri-modal age distribution peaking at approximately 1-3 years, 16-19 years, and 43-46 years. In more detail, the age distribution was observed to be 5.3% under 12 years, 22.2% from 12-20, 66.4% age 21-64, and 6.1% 65 years or over. Over half of cases (56.5%) were classified as involving intentional self-harm, with over one-quarter (28.8%) of these occurring in the 12-20 age bracket. A total national bill of \$11.6 billion (\$US 2013) was observed across both ED and inpatient settings, averaging \$2,744 (2,725) among those treated and released from the ED and \$25,841 (43,895) per inpatient case. The average length of stay was 3.4 (5.0) days for inpatient

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admits. Across all cases, the top Elixhauser comorbidities involved depression (23.0%), drug abuse (20.1%) psychoses (14.3%), hypertension (13.0%), and alcohol abuse (12.9%). Specifically for older persons 65 years and above, these included hypertension (46.2%), fluid and electrolyte disorders (27.6%), diabetes (19.3%), COPD (18.7%), and depression (17.2%). While the number of cases changed only slightly across most age categories from 2006 to 2010, the greatest increase was noted among those 65 and older (i.e., from 9,381 in 2006 to 11,979 in 2010, +27.7%). Relative to treat-and-release ED cases, results of the multinomial logit regression of discharge status indicated significantly higher likelihoods of inpatient admission ($p < 0.05$) with all 30 Elixhauser comorbidities and ranging from 1.41x (renal failure) to 25.0x (peptic ulcer disease without bleeding). Furthermore, an increased likelihood of inpatient mortality was significantly associated ($p < 0.05$) with most Elixhausers except depression and peptic ulcer disease, ranging from 1.55x (psychoses) to 43.54x (coagulopathy). Increased charges were significantly associated with all Elixhauser comorbidities except lymphoma, ranging from 1.12x (solid tumor) to 3.03x (cachexia/weight loss syndrome). Longer lengths of stay were also significantly associated ($p < 0.05$) with most Elixhauser comorbidities (except hypertension or diabetes with complications, hypothyroidism, lymphoma, solid tumors, rheumatoid arthritis/collagen vascular disease, alcohol abuse, and psychoses), ranging from 1.07x (valvular disease) to 2.10x (cachexia/weight loss syndrome). Invasive mechanical ventilation was utilized in 5.8% of cases overall ($n = 50,416$), concentrated across the 21-64 age bracket (87.2%, $n = 43,984$). An increased odds of invasive mechanical ventilation was significantly associated ($p < 0.05$) with most Elixhauser comorbidities (except valvular disease, hypertension and diabetes with complications, renal failure, peptic ulcer disease, cancer, or blood loss anemia), ranging from 1.13x (peripheral vascular disorders) to 4.31x (fluid and electrolyte disorders). Relative to all other cases, those requiring invasive mechanical ventilation incurred increased likelihoods ($p < 0.05$) of 28.59x for mortality, 4.14x for charges, and 1.73x for lengths of stay.

Conclusion: From 2006 to 2010, 872,974 ED cases of acetaminophen toxicity occurred within the United States, 44.2% resulting in a direct inpatient admission, with a mortality rate of 0.8% and a national bill of \$11.6 billion.

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44-M

Category: Practice Research / Outcomes Research / Pharmacoeconomics

Title: Examining the acceptance rate of pharmacist recommendations between physicians and nurse practitioners

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Purpose: The intent of this study was to compare the acceptance rates of pharmacist interventions between physicians and nurse practitioners. This study further explores the acceptance rates of specific drug therapy problem interventions.

Methods: This retrospective review was conducted at two ambulatory care clinics each with one practicing physician and nurse practitioner. Interventions made by the pharmacist from February 2013 to February 2014 were divided into 3 categories (indication, effectiveness, and safety) which were further dissected into 6 drug therapy problems (dosage too low, needs different drug product, needs additional drug therapy, unnecessary drug therapy, adverse drug reaction, and dosage too low). All patients seen by the providers with any of the above drug therapy problems were included in the study. Analysis of variance (ANOVA) and chi-square models were used to compare the number of accepted recommendations with the number of rejected recommendations.

Results: A total of one hundred and seventeen interventions were examined. Data show that, proportionately, physicians reject more pharmacy recommendations than nurse practitioners ($\chi^2 = 42.26$, $p < 0.00001$). Regarding the mean number of recommendations acceptances, there is a significant difference in at least one drug therapy problem ($F = 36.1$, $p = 0.0002$), where needs additional drug therapy contains a significantly greater number of acceptances than other categories.

Conclusion: Based on the study results, physicians reject more pharmacy recommendations than nurse practitioners, but professional designation insignificantly influenced recommendation acceptance.

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45-M

Category: Small and Rural Pharmacy Practice

Title: Documentation and analysis of clinical pharmacy interventions in a small rural hospital

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Purpose: To increase pharmacist documentation of clinical pharmacy interventions in a 25 bed critical access hospital. The data can then be analyzed to determine the clinical functions which are most frequently performed, along with the required time and cost savings, and highlight the areas which need to be addressed.

Methods: The fiscal year of October 1, 2012, through September 30, 2013, for Montfort Jones Memorial Hospital was the time period evaluated in this study. Clinical pharmacy interventions are recorded daily in the RxSolutions Program provided by Comprehensive Pharmacy Services (CPS). The pharmacist looks up the patient or enters them into the system. The drug is selected and then the type of intervention is selected. Each pharmacist is able to log in individually and record all interventions they have performed. This program allows for better record keeping and easier documentation since the analysis is automated. Direct cost savings, the total net dollar savings actualized as a result of the accepted interventions that optimized medication utilization between the original service and the revised service, were calculated during this period. Indirect cost savings, costs that are incurred for common or joint objectives and, therefore, can not be identified readily and specifically with a particular sponsored project, were also included in this time period. All interventions, either manual or automated, during the time period were evaluated and are included in this paper.

Results: During the time period, the pharmacists recorded 3102 interventions. Of these 1025 (33%) were for warfarin adjustments, 687 (22%) for basal insulin adjustments, 277 (9%) for enoxaparin dosings, 265 (9%) for vancomycin dosings, 287 (9%) for potassium dosings, 137 (4%) for sincalide dosings, and 424 (14%) for other. The pharmacy director had 1151 interventions, the clinical staff pharmacist had 1426 interventions and the relief pharmacist had 525 interventions. The amount of time spent performing these clinical functions was 386.75 hours. There was \$35,566.89 in direct cost savings and \$717,208.51 in indirect savings. Only 3 interventions were not accepted, and 62 interventions were in the pending status. It was not possible to compare the results from this automated system with the previous automated one since the results are not accessible.

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Conclusion: Documentation of clinical pharmacy interventions not only shows the number of interventions, but it also shows the areas of focus for the different pharmacists. This process allows the director to create a climate of friendly competition in recording what once was thought of as a monotonous task. It also allows the director to focus the pharmacists attention on certain clinical activities with the greatest impact on improved patient care along with the resultant clinical savings. Clinical activities of the pharmacists are also presented at the Pharmacy and Therapeutics Committee (P&T) meetings to keep the doctors and administration informed of the values of these functions and to let them know that their requests had been handled. This is evident in the highest number of interventions involving high alert medications.

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46-M

Category: Transplant / Immunology

Title: Tacrolimus dosage requirements in lung transplant recipients receiving antifungal prophylaxis with voriconazole followed by itraconazole: a preliminary prospective study

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Purpose: Concomitant administration of the triazole antifungals, voriconazole or itraconazole, with tacrolimus can result in significant drug interaction in the transplant recipient. Limited published information exists regarding tacrolimus dosing when transitioning from voriconazole to itraconazole. The purpose of this study was to evaluate the extent of the drug interaction with antifungal prophylaxis using voriconazole followed by a switch to itraconazole in lung transplant recipients receiving tacrolimus.

Methods: This was an Institutional Review Board approved prospective study of patients who underwent lung transplantation at Mayo Clinic Florida from August 2011 through May 2012. Informed consent and HIPAA authorization were obtained from all study participants. Patients were included if they received tacrolimus and antifungal prophylaxis with voriconazole followed by a switch to itraconazole. Patients were followed from the time of transplant until two months after converting to itraconazole. All patients received standard immunosuppression with tacrolimus, mycophenolate mofetil, and a corticosteroid. Tacrolimus trough concentrations were measured in whole blood by liquid chromatography-tandem mass spectrometry. Patient demographics, clinical characteristics, immunosuppressive and antifungal medications, tacrolimus concentrations, renal and liver function tests, and potentially interacting medications were obtained from the electronic medical record. Tacrolimus dose normalized concentrations were calculated by dividing tacrolimus trough concentrations in nanograms per milliliter by the daily tacrolimus dose in milligrams per kilogram patient weight expressed in units of (ng/mL)/ (mg/kg). Comparison of dose normalized concentrations was evaluated by mixed effects linear regression models that included a random patient effect within phase. Differences in means between voriconazole and itraconazole were estimated along with 95 percent confidence intervals. P-values less than or equal to 0.05 were considered statistically significant, with no adjustment for multiple testing.

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Results: Twenty lung transplant recipients were included in the final analysis. Median age was 61 (range 28-69), 11 (55 percent) males, 13 (65 percent) had idiopathic pulmonary fibrosis as indication for lung transplant, and 18 (90 percent) received a double lung transplant. No difference was found with the tacrolimus dose normalized concentrations of voriconazole at 254 plus or minus 28 (ng/mL)/(mg/kg) compared to itraconazole at 234 plus or minus 34 (ng/mL)/(mg/kg) ($p=0.65$).

Conclusion: Tacrolimus dose modifications were not necessary when converting from voriconazole to itraconazole. Validation in a larger population is needed to confirm these findings.

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1-T

Category: Administrative practice / Financial Management / Human Resources

Title: Transformation of workplace culture via Implementation of shared decision making council in an Outpatient Pharmacy setting at the Cincinnati Veterans Administration Medical Center

Primary Author: Tina Hamilton; **Email:** tina.hamilton@va.gov

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Purpose: To develop a means to foster a climate of staff cooperation and front line staff empowerment (improved job satisfaction) to promote excellence in service and care to veterans, and their families through improving cooperation between staff and management.

Methods: A committee, Unit Practice Council (UPC), consisting of pharmacists and pharmacy technicians was elected by peers in the pharmacy to develop and sustain a series of initiatives to promote job satisfaction. The committee met monthly to develop an action plan. The plan consisted of 1) a survey of employees, through scheduled focus groups to determine what employees thought were key elements needed to provide excellent customer service; 2) a phone survey of 10% of veterans who used outpatient pharmacy services on a random date was used to determine level of satisfaction and 3) review and evaluation of data from the VA National All Employee Survey (AES). Results from these surveys were used to provide baseline data for evaluation of UPC generated initiatives. These initiatives included, a suggestion box to collect anonymous comments, a monthly recognition program rewarding employees for superior service, actions to improve communication with other services, including pharmacy tours, upgrading phones, introduction of wireless devices, to clarify pharmacy process of prescription counseling and medication pick-up, and development of a colorful workflow information card describing dispensing process that was distributed to clinics, providers and patients.

Results: Veteran phone surveys identified the most important factors of our service were timeliness, accuracy, and customer service (61%, 26%, and 7% respectively). Despite historically low customer service scores as measured by SHEP there were significantly more positive comments than negative, 90 versus 31. As a result of multiple initiatives, timeliness has improved from 67 min to 48 min in two years. Improvements were also found on the annual AES results one year following the committee initiation. The Outpatient Pharmacy had a 4% improvement in customer satisfaction and employee praise. There

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was also a slight improvement in job control and psychological safety. However, there were significant decreases in direct supervision, performance goals, and conflict resolution.

Conclusion: Time away from routine pharmacy responsibilities for implementation of UPC in the outpatient pharmacy was supported by management, resulting in numerous initiatives that improved employee satisfaction and enhanced patient care. Ongoing efforts will continue to evaluate the success of service specific initiatives using the Plan Do Study Act methods.

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2-T

Category: Administrative practice / Financial Management / Human Resources

Title: Development of a pharmacist cross-training program to maximize pharmacist resources and improve schedule flexibility

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Purpose: With the passage of the Patient Protection and Affordable Care Act (ACA) in 2010, health-systems nationwide are facing reduced reimbursement and must focus on cost reduction while maintaining high quality care. At the same time, the ASHP Pharmacy Practice Model Initiative compels pharmacy leaders to develop and implement comprehensive pharmacist competency, training, and education plans to expand pharmacists roles while increasing continuity of patient care across care settings. Pharmacy departments must therefore leverage existing resources to work more efficiently and match workload demand to achieve both imperatives. The Ohio State University James Cancer Hospital and Solove Research Institute Pharmacy services a 233-bed inpatient hospital and five ambulatory infusion centers. Traditionally, pharmacists have only been trained in one care setting, either inpatient or ambulatory infusion. The purpose of this program was to train ambulatory infusion pharmacists to provide patient care in the inpatient setting, thereby maximizing their efficiency.

Methods: Inpatient-ambulatory cross-training was piloted with one pair of pharmacists who each covered gynecologic oncology patients, but in dedicated inpatient or ambulatory settings. Both pharmacists received additional training, and then rotated positions. Over a six-month period, this pilot was deemed successful based on pharmacist feedback and minor improvements in schedule flexibility. After the successful pilot, all pharmacists except contingent staff and second shift pharmacists were designated for cross-training. A small stakeholder subgroup was formed consisting of front-line staff, pharmacy managers, and an administrative pharmacy intern. The subgroup discussed training requirements, determined coverage for pharmacists training, and identified specific responsibilities for cross-trained pharmacists. Previously developed materials utilized for training new inpatient staff were modified to reflect this unique training situation. The ambulatory pharmacists were already proficient in the electronic medical record (EMR) and possessed significant expertise in managing chemotherapy, so the cross-training focused primarily on understanding inpatient medication distribution and managing the acute needs of inpatient cancer patients. After approximately half of the ambulatory pharmacists received initial cross-training, the subgroup reconvened to identify any gaps in the current training

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structure. At the midpoint evaluation, expectations were clarified, training materials were revised, and additional information was provided to staff as they progressed through the training.

Results: In less than a year, 19/24 (83%) ambulatory infusion pharmacists received inpatient cross-training. Due to scheduling constraints and staff feedback, cross-trained pharmacists were divided into two groups (comprehensive and supportive) to better utilize pharmacist skills and experience and allow for maintenance of full inpatient competency in a select group of pharmacists. Four of nineteen ambulatory pharmacists received comprehensive inpatient training. These pharmacists are routinely scheduled inpatient shifts to maintain full inpatient competency. The remaining (15/19, 79%) pharmacists received supportive inpatient training to understand inpatient workflows, verify inpatient orders remotely from the ambulatory infusion locations, and cover inpatient orders during ambulatory weekend shifts. This cross-training allowed efficient distribution of labor resources better matching workload demands. During downtime in lower-volume ambulatory infusion areas, pharmacists were able to remotely verify inpatient orders or assist with second verification of chemotherapy for other ambulatory infusion sites. Significant gains, as reported by the schedulers, in weekend staffing flexibility and call-off coverage were realized.

Conclusion: An inpatient-ambulatory cross-training program developed with staff input and feedback can improve schedule flexibility and better match work resources to workload demands. Future directions include the creation of formal competency assessments and potentially extending cross-training for second shift staff.

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3-T

Category: Administrative practice / Financial Management / Human Resources

Title: Implementing and assessing the impact of supply chain strategies on pharmaceutical expenditures

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Purpose: Pharmacy departments currently face a challenging macroeconomic environment. To achieve success in such an environment, this project sought to increase cost control and accountability at the University of Virginia Health System while simultaneously improving the departments supply chain.

Methods: At the onset of the project, stakeholders collaborated to develop various business support tools. These tools provided insights on product utilization, purchase prices, and departmental inventory levels. Thereafter, these tools were leveraged to provide business intelligence while introducing systematic changes within the department. Initial changes focused on optimizing departmental inventory to align on-hand inventory with average utilization. Subsequently, purchasing practices were redesigned to ensure that orders were systematically reviewed prior to submission. Following this change, stakeholders were provided a daily budget for all purchases; any variances were communicated daily and escalated as necessary to key stakeholders on a daily or weekly basis. Throughout the overall project, various members of the project team collaborated to ensure 340B integrity at the organization and to optimize the departments split-billing system (Talyt AutoSplit). The impact of these various interventions was assessed monthly utilizing a balanced supply chain scorecard. Performance metrics on the scorecard included average daily drug spend, emergency orders per month, carrying cost of inventory on hand, inventory turns per month, proportion of pharmaceuticals purchased at unfavorable price points (wholesale acquisition price or WAC), as well as overall performance relative to the budget. Current data suggest that these changes have had a favorable impact on departmental performance. In particular, the department has seen favorable reductions in overall inventory levels without increases in the reliance on emergency orders and increased product movement as measured by inventory turns. Average daily spend has improved as well as departmental performance versus the budget; however, additional steps will be necessary to meet organizational expectations. Additional data will be available at the time of the meeting as well as formal conclusions regarding the success of the project.

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4-T

Category: Ambulatory Care

Title: Establishing a Tobacco Cessation Clinic at a Student-Run Free Clinic

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Timothy Chen

Purpose: The University of California San Diego (UCSD) Student-Run Free Clinic Project, in partnership with the community, provides accessible, high quality, free-of-charge health care for lower socioeconomic individuals. Patients with lower socioeconomic backgrounds tend to have higher prevalence of tobacco use disorder. The Student-Run Free Clinic has traditionally addressed tobacco use with all patients, however, it is often overshadowed. Due to the need of this specialty service, a group of student pharmacists and tobacco cessation pharmacist came together to launch a Specialized Tobacco Cessation Clinic (STCC).

Methods: A team was established to pursue the formation of the STCC clinic at one of the three free clinics (Pacific Beach Clinic). Members of the team include student pharmacists and a pharmacist attending, who is a tobacco cessation expert from the National Tobacco Cessation Clinical Resource Center (TCCRC) for the Veterans Health Administration (VHA). Once a team was established, discussion regarding the implementation of the STCC began with the free clinic leadership, whom all gave full support. Financial support for medications (e.g. nicotine replacement therapy) will be pursued through donations, grants, and support from local professional organizations. Training: A three-hour modified Rx for Change curriculum with emphasis on case examples and special populations was developed. A student teach student training model was adopted where APPE students that rotated through the TCCRC prepared the didactic portion of the training under supervision. Clinical training was planned within the context of STCC launch. Clinic Structure: The STCC team and Free Clinic leadership discuss clinic referral and logistics. Ultimately, it was decided that the STCC would enroll patients through referral from the healthcare team (e.g. medical and pharmacy students, attending physicians) and a print out of identified smokers. When a patient is identified, patients would receive full behavioral counseling and medications from the STCC team when patient is ready to make a quit attempt (within 30 days). STCC follows the 5As (Ask, Advise, Assess, Assist, Arrange) and evidenced-based motivational interviewing strategies (MI) such as the 5Rs (Risk, Rewards, Roadblocks, Relevance, Repetition) to provide evidenced based tobacco treatment to patients. Stress management and weight gain concerns are also addressed through patient education and cognitive behavioral treatment.

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Results: The STCC was successfully established January 2013. Didactic training conducted by the APPE students under supervision was delivered December 2012 preceding the initiation of the STCC clinic. After one year, the STCC has had over twenty patients enrolled in the clinic at various stages of change (not ready to quit, think about quitting, ready to quit, former tobacco user). The STCC has gained considerable presence at the Pacific Beach Free Clinic since its launch in January 2013 and now operates on a weekly basis. The attending physicians have seen the benefits of the STCC and have developed a solid rapport with STCC team, further evolving to a STCC/medication management program (MMP). After a year of clinic sessions, the 2013-2014 team of students have initiated the student train student model for the next group of pharmacy students for the June 2014 to June 2015 term.

Conclusion: Based on the need of a STCC within the UCSD Student-Run Free Clinic project, the clinic was successfully launched and has become a staple of clinical pharmacy services at the free clinic. It has also contributed to the establishment of an adjacent MMP. Future goals will be to expand the program to other free clinic sites and to conduct data analysis on the success of obtaining engagement from patients.

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Professional Poster Abstracts

5-T

Category: Ambulatory Care

Title: Evaluation on the safety of anti-coagulation therapy in patients newly initiated on warfarin, in Singapore General Hospital

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Purpose: To evaluate the safety of anticoagulation therapy in patients newly initiated on warfarin, with reference to all stable warfarin patients, in Singapore General Hospital (SGH).

Methods: A list of all patients prescribed with warfarin was generated from the Pharmacy Dispensing System and then filtered to identify for patients newly initiated on warfarin in the period between 1st Dec 2011 to 31st May 2012. Patients identified were then followed up for a period of 6 months. The rate of hospitalization due to complications of anti-coagulation therapy and total number of International Normalized Ratio (INR) greater than 4 were recorded. The cost of hospitalization due to complications of warfarin therapy as well as cost of routine follow up was calculated. The above were then compared against patients already stable on warfarin (on therapy for greater than 6 months).

Results: A total of 141 patients were newly initiated on warfarin during the study period. The total rate of hospitalization due to complications of anti-coagulation therapy was 11.3 percent (2.8 percent due to major bleeding, 8.5 percent due to minor bleeding). When compared against patients stable on warfarin, the rate of complications in newly initiated patients was almost 3 times higher (3.8 percent vs 11.3 percent). In our study group, patients who were initiated on warfarin with INR titrated to target range as inpatients had excessive rates of bleeding episodes (15.1 percent) as compared to patients who were initiated and/or titrated on warfarin to target INR as outpatients (6.7 percent). The average incidences of INR greater than 4 were also higher amongst inpatients (0.70 plus minus 1.1) versus outpatients (0.33 plus minus 0.62). Patient stable on warfarin required an average of 3 follow up visits per patient, while newly initiated patients required 9 follow up visits per patient.

Conclusion: Patients newly initiated on warfarin were at a heightened risk of bleeding complications as compared to patients already stable on warfarin therapy. This also translates to considerable costs of warfarin initiation. The incidence of complication appears lower in patients initiated/titrated on warfarin as outpatients and this may present as a feasible method of reducing complications and cost of warfarin initiation.

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Professional Poster Abstracts

6-T

Category: Ambulatory Care

Title: Pharmacist-driven program improves perioperative glycemic control in surgical patients with dysglycemia

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Purpose: Hyperglycemia is a risk factor for increased perioperative adverse events. Current evidence has shown that improved glycemic control reduces surgical site infections, post-operative complications, length of stay, and morbidity and mortality. However, limited availability of expert clinicians may adversely impact the safety and efficacy of controlling dysglycemia in surgical patients. Retrospective data collected at a single county medical service center revealed that patients undergoing surgery had suboptimal perioperative glycemic control. These data suggest a need and opportunity for improving the safety and quality of perioperative glycemic control. This study was designed to implement a pharmacist-driven glycemic control program in the management of perioperative patients.

Methods: A group of clinical pharmacists implemented a consultation program to manage perioperative dysglycemia in a single county medical service center. An observational study design was used to assess the programs efficacy in glycemic control. The program included all dysglycemic patients undergoing general surgery or same-day procedures. Outcomes for patients with good glycemic control and with hypoglycemia were compared with the facility's usual care (defined as patients who did not receive a pharmacist consultation prior to surgery). Good glycemic control was defined as having a blood glucose value between 70-180 mg/dL during the perioperative period. Hypoglycemia was defined as having a blood glucose value less than 70 mg/dL during the perioperative period. Interventions made pre-operatively included: (1) ensuring that relevant labs were current, (2) reviewing medication therapy, (3) managing dysglycemia per protocol, (4) adjusting pre-operative insulin regimen, and (5) identifying high-risk patients due to uncontrolled glycemic status and discussed with surgeons, including the need to post-pone elective surgery. Interventions made on the day of surgery included ordering point-of-care (POC) glucose and recommending appropriate treatment for hypo- or hyperglycemia, respectively. Results were analyzed by descriptive statistics.

Results: The usual care control group included 155 patients and the intervention group included 551 patients from January 1, 2012 to December 31, 2013. During the pre-operative period, more blood glucose levels were drawn in the intervention group compared to the control group (92.7% vs. 89.7%).

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There was no difference in the mean blood glucose value pre-operatively. The number of patients with hyperglycemia prior to surgery was greater in the intervention group (48.1% vs. 27.7%). The number of POC glucose drawn on the day of surgery was greater in the intervention group (99.6% vs. 72.3%). Overall, the percent of cancelled surgeries due to hyperglycemia was less in the intervention group compared with the control group (7.6% vs. 23.2%).

Conclusion: This study has illustrated the importance of clinical pharmacists in managing patients in the perioperative setting, indicated by the increased number of referrals for hyperglycemic patients. Implementation of a pharmacist-driven glycemic control program led to safer and better quality of care as indicated by improved glycemic control and decreased surgery cancellations. However, since this study is a descriptive quality initiative, the clinical significance of these results must be determined in larger, prospective trials.

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7-T

Category: Ambulatory Care

Title: Assessing adherence to calcium and vitamin D therapy and the reasons for non-adherence in osteoporotic or osteopenic ambulatory patients

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Purpose: The primary outcome of this study is to assess osteoporotic or osteopenic ambulatory patients adherence and persistence with their calcium and vitamin D therapy. The secondary outcomes are to 1) identify the reasons beyond their non-adherence and 2) evaluate the relationship between patients adherence and different age groups

Methods: Study design: Prospective- qualitative survey carried out from October till December 2013. Patients: The study included all patients who attended secondary care Rheumatology clinic in a teaching hospital in the period between October to December 2013 and receiving calcium and vitamin D therapy. Inclusion criteria: Patients aged 18 years old, diagnosed with osteoporosis or osteopenia, taking calcium and vitamin D therapy for at least one year, and willing to participate in the study. Patient flow: Total of 341 patients underwent the self administer quesstionair initailly, where 52 were excluded due to incomplete/missing data, 13 were below 18 years old. It ends up with 276 patients who fully fill the criteria and appropriately fill the questionnaire. Data collection: Clinical pharmacist attended the outpatients Rheumatology clinic carrying out the questionnaire in the assessment room after obtaining the consent forms from each patient. Standardized compliance questionnaires (Morisky 8-Item Medication Adherence Questionnaire) with some modifications regard different dosing regimen of vitamin D (once, twice or thrice weekly and monthly bases) were used. Statistical analysis: Usage of SPSS software - Descriptive statistics including frequencies, percentages and significant difference between categorical groups measured by Chi-square test Ethical consideration: This study was reiewed and approved by HMC research and ethics committee. A consent form was obtained from each patient before commencing the questionnaire

Results: This study included 276 patients who met the inclusion criteria. Out of these, 11 patients were taking calcium (4%) and 148 patients were taking vitamin D (53.6%) and 117 patient were taking both Calcium and Vitamin D (42.4%). Age group B (40-59 years) was dominant in this study, representing around 45% in both groups (45.3% in Calcium group and 44.9 % in Vitamin D group). On the other hand around 1% of the patients were aged 80 years and above (age group D). Data regarding education level

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were collected; a round half of the patients education level was college or higher (46.1% Calcium group and 47.9% Vitamin D group). There was no statistically significant difference between Calcium and vitamin D group in terms of adherence score (low, medium and high; $p= 0.673$). More than third of studied patient in both groups showed low adherence score; 37.5% of patients in Vitamin D group while it was 32.8% in Calcium group. Medium adherence score was 36.1% (37.5%, 35.5% in Calcium and Vitamin D respectively). Comparing the adherence score between all age groups retrieved no statistical difference ($p=0.035$) Forget to take medication achieved the highest percentage (16.5%) among the reasons of non adherence in both group (15.6%, 17.0% for Calcium and Vitamin D respectively). On the other hand lack of benefits showed the least percentage (0.8%) as reason of non adherence among studied patients with 0% in Calcium group and 1.1% in Vitamin D group. 12.5% of patients stated that multi-reasons will lead to their non adherence including: cost, side effect, availability, poly-pharmacy, condition improved and forget to take medications

Conclusion: Low adherence was high among both Calcium and Vitamin D groups (around third of both groups), however; there were no significant differences in medications adherence between the two groups Forget to take medication was the main reason for non adherence. The current study shows the current adherence status among such patients towards their therapy and promotes further studies to be done to improve patients adherence and eventually their health outcome

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8-T

Category: Ambulatory Care

Title: Clinical pharmacist interventions in refill clinic at tertiary care eye specialist hospital

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Purpose: There were a lot of studies that demonstrated the experience and the benefit of clinical pharmacist to manage the refill program in different areas such as cardiac disease and asthma. Unfortunately, the evidence literature review of clinical pharmacist role in ophthalmic filed were very limited. So, the aims of this study are: Determine the most common clinical pharmacist interventions in ophthalmic filed, expedite the stabilized patients access to chronic medications, prevent unnecessary interruptions during the therapy, enable physicians to give more attention to acutely ill patients, and maintain patient compliance.

Methods: This is a prospective study where the data had been collected since the clinic launched in June 2011 till December 2013. The clinic is a chart review based clinic and working hours were from 7:30 - 16:30 in the weekdays only. Clinical pharmacist was authorized to provide the following services: o Write prescription renewal. o Prescribe certain new medications (restricted to lubricants and over-the-counter medications only), o Adjust therapy. o Order labs. o Monitor patients as certified eye screener in hospital (assess Intra Ocular Pressure (IOP)/ Visual Acuity (VA)). o Request urgent follow up appointments. The patient would be called to the clinic whenever there is necessity (IOP check, lab requested). The medical record number was the only way to identify the patient in daily log sheet to preserve patient confidentiality. All prescriptions written by a clinical pharmacist were valid for 2 weeks from original date of issue. All prescriptions older than 2 weeks were to be declined by outpatient pharmacy. Any patient who was not claiming his prescription within 2 weeks of its issued date or not been seen in ophthalmologist clinic for more than 1 year was considered as noncompliant.

Results: Total of 16,417 patients were seen in medication refill clinic from June 2011 to December 2013. Out of the total, 3,641 (22.2%) were noncompliant. The clinical pharmacist identified 17 intervention types. The most frequent interventions were: Eye screening (24.8%), patient Counseling (13%), Physician/ER referral (12.4%), Therapeutic substitution/switch (10.8%), and Frequency changed (7%). Number of noncompliant patients who did not claim their prescription in the validity period was 1153. The number of noncompliant patient who were not seen for more than 1 year was 2483. There was a decrease in number of patients, not seen for more than 1 year from 2011 to (45.9%) compare to 2013. The averages of noncompliance percentage due to unclaimed prescription were (8.95%, 5.85%, and

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8.50%) for the years 2011, 2012, and 2013 respectively. The averages of noncompliance of patients not been seen for more than 1 year were (24.38%, 15.49%, and 8.57%) for the same duration respectively. The clinic improved the compliance as the number of patient not been seen for more than 1 year which was decreased from 1021 patients in 2011 to 552 patients in 2013 (45.9%)

Conclusion: This prospective analysis showed positive outcomes in the management of ophthalmic patients by clinical pharmacist. Dissemination of this information would be valuable because it could raise the awareness to other healthcare professionals regarding pharmacist as effective clinician in care of ophthalmic patients. This increased awareness could evaluate the profile of pharmacists engaged in such activities.

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9-T

Category: Automation / Informatics

Title: Customization of Epic functionality for primary care pharmacist clinical documentation.

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Purpose: We received a grant from the Center for Medicare and Medicaid Innovation Center (CMMI) for the Improving Health in At-Risk Rural Populations (IHARP) program. One key element of this program integrates pharmacists in patient centered medical homes (PCMHs) to optimize medication therapy for patients with multiple chronic diseases. To meet the programs clinical reporting needs, which include identification and characterization of medication related problems (MRPs), patient adherence assessments, documentation of the recommended pharmacist interventions, and their associated estimated economic outcomes, we worked with Carilion Clinics Technology Services Group (TSG) to extend the Epic electronic medical record system to capture these project data.

Methods: The initial step in the process was evaluation of available software support system options. Key evaluation elements were documentation complexity, inclusion of all required data elements, ease of communication among the health system team and our community partners, ease of report generation to monitor project metrics and meet CMMI requirements, and cost. Evaluation of three commercially available systems revealed that none met all our needs; most would necessitate duplicate data entry, would result in two separate databases with potentially discordant data, and would require significant training to use effectively. Customizing Epics functionality to meet our project needs was our most cost-effective option. Members of Carilions TSG with expertise in Epics inpatient functionalities, outpatient functionalities, database structure, and reporting capabilities assisted in the customization process. The Epic training team was also engaged from the beginning of the project. The planning process entailed establishment of program requirements, defining workflows for patient enrollment and subsequent encounters, and defining data storage. Implementation required creation of an IHARP department within Epic, construction of customized, IHARP-specific documentation flowsheets and encounters, and customizing clinical permissions for primary care pharmacists.

Results: Extending the Epic system to meet our project needs keeps all data secure and accessible to all Carilion Clinic providers and our community pharmacist partners. Implementation was accomplished in

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approximately 4 months in the fall of 2012. The single database ensures that all data is current and available to all project personnel. Using the current EMR also leverages built-in, secure messaging between providers, including partnering community pharmacists. The system utilizes live system lists to identify potentially eligible hospital patients. Setting an FYI Flag identifies a patient as enrolled. An inpatient-specific documentation flowsheet is used by pharmacists to document each step of the enrollment and discharge process. Customized chronic disease state management plans can be individualized for patients in the hospital or PCMH. In the PCMH clinical pharmacists have documented over 2,700 encounters in 1,162 patients enrolled in the first year of the project. Weve documented over 3,000 interventions during 72-hour follow-up calls after hospital discharge, face to face encounters, and telephone encounters. Viewing all patient notes and labs, documenting vital signs, and updating current medication lists are done through Epics standard interface. However, responses to project-specific questions, medication related problems, their follow up, and the outcomes associated with the pharmacists interventions are documented within the customized documentation flowsheet along with estimates of cost avoidance.

Conclusion: Building upon the existing EMR structure used by Carilion Clinic has streamlined the ability of our team to carry out project-specific documentation and leveraged the capabilities already built into the system. The pairing of the IHARP and TSG teams synergized the development and implementation processes. The TSG teams expertise in data structure, reporting, and education, was crucial for a robust implementation. Since Epic is used in all clinical environments within Carilion Clinic, the task of deploying and educating participating staff was minimized. The customization produced a vehicle for data documentation that has met project needs in a timely and cost-effective fashion.

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10-T

Category: Automation / Informatics

Title: Improving the safety of an oncology computerized order entry system using the failure modes effects and analysis process

Primary Author: William Rickley; **Email:** william.rickley@atlantichealth.org

Purpose: A multidisciplinary team representing three hospital oncology infusion centers in an integrated health system was convened to conduct a failure mode effects and analysis (FMEA). This team was charged with describing how work flow changed following implementation of computerized provider order entry (CPOE) in the oncology infusion centers, identifying steps in the process with high risk for failure that may lead to patient harm, and identifying actions needed to eliminate or considerably reduce the risk associated with outpatient chemotherapy.

Methods: The FMEA team mapped the new work flow process for chemotherapy in five main areas: prescribing, nursing assessment, lab result review, pharmacist verification and preparation, and treatment administration. The sub-processes in each of these areas were mapped and a hazard analysis was conducted to identify those process steps at highest risk for failure. This was done by having the team identify each potential cause for failure and then reach consensus on scoring the probability and severity of the occurrence of an adverse event at that step. Hazard scores were computed by multiplying the scores for probability and severity. Any potential cause of failure with a hazard score above the indicated threshold and without an acceptable mechanism to detect and prevent that failure from occurring had an action plan put in place to remove or limit the risk of patient harm.

Results: Of the 34 total process steps identified, five were found to be highly problematic with 13 potential causes scored as highly hazardous. Fifteen specific tasks were assigned to team members as part of our corrective action plan to address these potential causes. Nine tasks involved targeted retraining of CPOE users including physicians, nurses, and pharmacists. Five tasks involved process standardization between the hospitals which included order clarification, staffing, and patient scheduling to improve work flow. Lastly, one task involved improving access to the CPOE software for practitioners by upgrading the network server. The action plan was carried out and after implementing changes, a reassessment of the process which included hazard analysis rescoring was conducted. Successful retraining of users, implementation of the recommended process changes, and the server upgrade resulted in eight of the original 13 potential causes for harm scoring below the hazard threshold. Of the remaining five processes at risk of causing harm, four were now deemed highly detectable due to in-process check redundancy by nurses and pharmacists. The one remaining potential

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cause of harm involves the possibility of prescribers selecting the incorrect chemotherapy regimen from the CPOE system menu.

Conclusion: The use of FMEA by a multidisciplinary team during the implementation of an oncology CPOE system can be an effective tool to assess the risk for harm when changing from a paper ordering system. Our work identified at-risk areas of concern and allowed for targeted corrective action that improved the safety and effectiveness of the process for providing chemotherapy as twelve of the 13 identified potential areas of risk were resolved. Additional benefits to organizing a multi-site FMEA team showed reduced total number of hours spent on the initiative and supported building a collaborative network in solving common problems.

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11-T

Category: Automation / Informatics

Title: Implementation of network server for TPN order entry

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Purpose: Currently pharmacists at the University of Virginia Health System (UVAHS) are only able to enter total parenteral nutrition (TPN) orders for compounding from a central computer with a TPN calculation application in the IV room. This process increases the time and requires an extra step in the already complex workflow for TPN compounding. Implementing a network server version of the application would allow the verifying pharmacist to place the TPN order outside of the IV room and reduce the number of order corrections, extra personnel and risk of errors in TPN order entry.

Methods: The budget for this project has been approved in the previous fiscal year. Technical specifications have been acquired from the vendor and a project implementation plan has been developed with technical services and pharmacists. Prior to research, contract negotiations for the additional services will be completed. The UVAHS electronic medical record will be used to determine all TPNs that have been dispensed within a given time period. The following data will be collected for each order: type of TPN, order date and time, type of dispense, dispense dates and times, TPN compounding dates and times, time of discontinuation, delivery location, return status of each dispense, administration dates and times, ordering user provider type. Additional data will be collected from the hospital error reporting system. This data will be used to determine time to order, number of TPNs ordered prior to institutional cutoff times, time to compound, the number of orders that were corrected and reordered, and the number of reported safety events related to TPN compounding.

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12-T

Category: Automation / Informatics

Title: Improving efficiency and reducing medication fill errors of medication trays and kits

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Purpose: The medication use process is increasingly complex, with new technology used to help ensure patient safety. Quality assurance should monitor that new technology and processes are safe and effective over time. Radio frequency identification (RFID) scanning cabinets are a new technology used to verify the names and expirations dates of medications used to refill medication kits. The goal of this technology is to decrease the amount of time it takes to refill and accurately document contents for the kits, such as crash cart trays and emergency medication bags. As the University of California Davis Medical Center (UCDMC) pharmacy implements RFID scanning, we seek to determine if the technology will decrease the time it takes to refill kits, reduce the potential for fill errors, and increase pharmacy staff satisfaction with the medication kit refill process.

Methods: To determine the change in efficiency for medication kit refills, the time spent refilling all kits during two, separate month long assessment periods were compared. Baseline data was obtained just prior to implementation, while the comparison month was measured after a four month wash-out period. All error reports for the calendar year of implementation were reviewed for patient safety concerns related to the use of medications from kits prepared by pharmacy; this period included approximately 6 months prior to and 6 months after implementation. Using the average number of kits filled after implementation and the time spent filling kits, an average cost of labor and RFID tags was calculated. Finally, staff satisfaction surveys were distributed before and after implementation to measure perception of safety and process efficiency elements using a five point Likert scale.

Results: With the implementation of RFID scanning there was a decrease in the amount of time it takes to refill the three primary medication kits. This decrease was statistically significant for one kit type for pharmacy technicians and for all three kit types for pharmacists. This has allowed the pharmacy to use this technology to make 23 types of kits, compared to the 13 kit types made prior to implementation. Since implementation, zero medication filling errors involving medication kits and trays filled by pharmacy staff using RFID scanning technology have occurred. Additionally, the technology has been used for one, efficient, product recall. Finally, the average pharmacy labor costs for filling kits are lower, allowing staff to fill an expanded number of kit types and complete other pharmacy functions. However, there is an additional cost incurred for affixing RFID tags to each medication. Results from the

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satisfaction survey show an increase in positive responses across all elements. There was a statistically significant change in the responses, with the elements and scores improving as follows: the process is efficient (3.38 to 4.45); there is little potential for error (2.63 to 4.45); pharmacists have adequate time to devote to other tasks (2.75 to 3.64); there is little potential to dispense an expired product (2.13 to 4.55); and, the amount of paperwork for documentation is reasonable (3.25 to 4.55). The increase for the element I am satisfied with this part of my job increased, but was not statistically significant (2.63 to 4.45).

Conclusion: After implementation of the RFID scanning, the medication kit refilling process is streamlined and automated. The process has improved the efficiency and safety of filling medication kits for our patients. This gain in efficiency has allowed the same staffing level to work on ten new types of kits; further expanding the patient safety improvements of this system. As medication and kit composition information are stored digitally, inventory management, staff workload monitoring and medication recalls are easier and more efficient.

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13-T

Category: Automation / Informatics

Title: Development of an electronic competency assessment for outpatient oncology pharmacists

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Purpose: The Joint Commission (TJC) Human Resources standards HR.01.06.01 states that organizations must ensure that all staff is competent to perform their responsibilities. Specific elements of performance within this standard dictate that the hospital should define the competencies it requires of its staff performing patient care activities and that an assessment method should be used to determine competence in the skills being assessed. The introduction of electronic medical records has added a complexity on how to evaluate a clinicians level of competence. The integration of clinical skills with information systems has made it difficult to assess clinical competency without taking into consideration the level of proficiency with ordering and processing orders within that electronic information system.

Methods: A pharmacy intradisciplinary team collaborated to define the skills and competencies required of outpatient oncology infusion pharmacists. This team consisted of pharmacy administrators for infusion services, the Oncology Pharmacy Informatics team, oncology disease specific specialty pharmacists and oncology infusion pharmacists. The team determined that areas of focus should include chemotherapy plan order manipulation, standard chemotherapy workflows, common errors, common questions and system vocabulary. It was decided that the test should be conducted using one of the available build environments within our electronic information system and that pharmacists should perform all functions of the test as if they were working on a real infusion clinic patient. The disease specific specialty pharmacists played a significant role in identifying clinical scenarios to set up the test patients. The most challenging task was developing a grading rubric that would assess each question objectively. The team determined a list of competencies that were considered critical competencies due to the clinical impact that could result from making these errors. Pharmacists had to achieve an 80% score on all testable points as well as those deemed critical. A hem/onc pharmacy specialist, who is also a member of the Oncology Pharmacy Informatics team and certified within the application, developed the grading rubric and validated it with the clinical lead disease specific specialty pharmacists to ensure that it measured the competencies that had been identified by the intradisciplinary team.

Results: The competency was comprised of 4 patient cases, 4 multiple choice questions and 2 situations requiring short explanation for a total of 59 evaluable points (20 critical points). Eighty percent of the

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test involved patient scenarios in which the infusion pharmacists were asked to manipulate orders in the electronic medical record as they would with real patients. The other twenty percent were questions to assess their knowledge on common questions, common errors and system terminology. The majority of missed points revolved around understanding the vocabulary and nuances of the system and how to optimize workflows within our institution. A total of twenty eight pharmacists were tested within a two month period of which 25 percent did not pass initially. All pharmacists that took the test were scheduled time with a member of the Oncology Pharmacy Informatics team to review the test with an emphasis on questions that were answered incorrectly. The pharmacists that initially did not pass the competency were required to re-take the exam to ensure they understood the tested concepts and to demonstrate competency within the system. Finally, a signed copy of the score was placed in each employee file.

Conclusion: Using an electronic competency assessment that mimics the real live environment by forcing pharmacists to manipulate orders as they would for clinic patients proved to be an effective method for assessing oncology pharmacy staff competency and system proficiency. In addition to satisfying internal and Joint Commission competency standards, with the development of an electronic competency we were able to identify areas in which to strengthen our new pharmacist training program.

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14-T

Category: Automation / Informatics

Title: Time-motion analysis of barcode medication administration of a high risk high alert medication

Primary Author: Heidi Chen; **Email:** heidi.chen@va.gov

Purpose: Veterans Health Administration medical centers began implementing barcode medication administration (BCMA) in 2000. Since then, the BCMA software has undergone multiple upgrades and modifications. A recent enhancement to the software allows medications to be marked as high risk high alert (HRHA) medications. Prior to this upgrade, these medications required an independent double check by another registered nurse prior to administration to the patient. The name of the witness could then be logged in BCMA by the nurse administering the medication. Following the activation of the new functionality, the witness would be required to enter his/her access code and password after performing the independent double check and before medication administration could continue. The addition of a hard stop prior to the administration of HRHA medications may decrease medication errors during the administration process. However, this additional task could impact current nursing workflow and lead to inefficiencies for nursing. Furthermore, workarounds could be developed that may decrease patient safety, thus negating the benefits of BCMA. This study aims to categorize the tasks involved in subcutaneous insulin administration and quantify the difference in time required to complete each task using time and motion analysis prior to and following the installation of the HRHA functionality.

Methods: The study will be an observational, prospective time and motion analysis. The administration process for subcutaneous insulin will be observed and timed from the time that the nurse enters the patient room to the time that the insulin is administered. Medication administrations completed by per diem/contract nurses, involving student nurses, or resulting in nurses being removed from the patients bedside for 2 or more minutes will be excluded as these may not be an accurate reflection of the time required to administer a medication. Nurses will be observed for 1 week before and after the release of the HRHA enhancement. Descriptive statistics will be used to analyze the collected time data.

Results: Data collection is in progress.

Conclusion: With the results of this study and in collaboration with nursing leadership, nursing workflow could be modified to accommodate the new HRHA functionality of BCMA to ensure that the administration process remains as safe and efficient as possible.

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15-T

Category: Automation / Informatics

Title: Enhancing electronic medical record access for pharmacy students

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Purpose: Pharmacy students are capable resources to provide patient education and care by acting as pharmacy extenders. At Harris Health System, we identified areas to expand the clinical scope of practice for pharmacy students during their pharmacy rotations. However, the students' ability to record care and track patient interventions was limited by their electronic medical record (EMR) access. This project was designed to expand the pharmacy student template in the EMR to allow documentation of clinical activities in an effort to further develop a student who understands their role in institutional healthcare delivery.

Methods: A survey was sent to pharmacy students completing rotations at the Harris Health System from November 26 to November 30, 2012. The survey assessed current EMR access, features within the EMR that students found beneficial and prior experience with an EMR. Results from the survey and evaluation of the EMR were utilized to identify gaps in the current student template. A security review was conducted in February 2013 and new features were incorporated into a new expanded pharmacy student template by July 2013. The new template was tested by pharmacy residents, students, clinical and operations managers to assess appropriateness of the new access from July to October 2013. The template was then approved by Information Technology (IT) security in December 2013. The template was implemented and a new EMR training session for pharmacy students completing the advanced hospital rotation was developed in February 2014.

Results: Twelve students completed the survey. Ninety-three percent agreed that the EMR was easily readable and reliable. All students stated that they were not able to or unsure of the ability to perform the following functions: create interventions and patient notes, document patient education, or perform medication reconciliation in their current template. Over 75% of students stated that the ability to create interventions and progress notes, document education, counseling, and perform medication reconciliation would be beneficial features for their EMR access. Student templates were reviewed by three pharmacy students. It was noticed that the students had view-only access. Through the security

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review, certain functionalities (i.e. documentation of patient education, recording interventions, and performing prior to admission medication reconciliation) were recommended to be changed from view-only to read, write and edit access. Documentation of patient care notes was also identified as a function requiring read, write and edit access with a required co-signature. These security points were added to the pharmacy student template and validated in two testing environments. During validation, security points allowing students to edit demographic data were changed to view-only access and the ability to write discharge orders was removed from the template

Conclusion: The new student EMR template was implemented in February 2014. Pharmacy students were trained on proper clinical documentation during their advanced hospital orientation. Training included documentation of interventions made by students for medication changes, drug regimen monitoring, as well as patient education for anti-coagulation, congestive heart failure (CHF), and chronic obstructive pulmonary disease (COPD) patients. Students utilizing the new template felt that the template allowed them to document and manage their clinical duties more effectively. Ultimately, the new template may be useful in optimizing patient care and utilizing students as pharmacy extenders.

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Professional Poster Abstracts

16-T

Category: Automation / Informatics

Title: Implementation of a computerized alert to reduce missed vancomycin trough draws

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Purpose: Vancomycin is a widely used antibiotic to treat serious gram-positive infections involving methicillin resistant *S. aureus* (MRSA). Clinical dosing strategies are based on various pharmacokinetic parameters to achieve therapeutic levels with the trough serum concentration being the most accurate and practical method for monitoring vancomycin effectiveness. Trough concentrations should be obtained just before the next dose at steady-state conditions. Timing of vancomycin trough lab draws by nursing was identified as a cause of several dosing errors, some resulting in toxicity. Trough lab draws were either missed or drawn late and subsequent dosing adjustments made were based on levels that were not true troughs. In an effort to reduce missed or late lab draws, UCI Health utilized functionality within the electronic medication administration record (eMAR) system (Allscripts) to introduce an alert prior to administration of the next dose.

Methods: Patients started on vancomycin undergo a pharmacokinetic evaluation by a pharmacist to recommend an initial dosing regimen. Based on the dosing interval of vancomycin, a related order for when to check vancomycin trough levels is ordered. For example, for vancomycin dosed every 12 hours, the trough is due prior to the 4th dose. The eMAR was configured to count the number of vancomycin doses administered. Then when the nurse barcode scans the 4th dose, an alert is triggered to remind the nurse that a trough level needs to be drawn. The alert requires the nurse to acknowledge the alert by either overriding the alert with a valid reason or completing the task of drawing a trough. Even if the alert is overridden, it will repeat for each dose until the task is completed.

Results: One month post-implementation, the alert fired 94 times for 47 patients. Twenty-four of these alerts were considered duplicate alerts in which the user triggered the alert more than once within a few minutes. Of the seventy valid alerts, 20 were overridden (29%). The remaining fifty alerts resulted in vancomycin trough labs being drawn (71%). Most of those lab draws resulted in therapeutic vancomycin levels requiring no dosage adjustments (N=26, 52%). Ten (20%) of the lab draws resulted in supratherapeutic levels (> 20 mg/L) requiring dosage adjustments to prevent toxicity. Fourteen (28%) of

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the lab draws resulted in subtherapeutic levels (< 10 mg/L) requiring dosage adjustments to prevent resistance and/or be considered effective doses.

Conclusion: Development of a computerized dose counter and associated alert of when to draw vancomycin troughs was helpful in reminding nurses. There is an opportunity to increase awareness of the alert to minimize the duplicate alerts. The timely draw of vancomycin troughs resulted in therapeutic dosage adjustments in a significant number of patients.

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Professional Poster Abstracts

17-T

Category: Automation / Informatics

Title: Design and implementation of an algorithm to detect look-alike/sound-alike medication errors: a pilot study

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Purpose: Look-alike/sound-alike (LA/SA) medications are associated with many medication errors and adverse events. The safe use of LA/SA medications is a standard required by the Joint Commission for accreditation. Despite the knowledge that LA/SA medications are problematic, interventions to eradicate these errors have not been identified. We designed and implemented an algorithm to identify likely LA/SA errors in a database of medication orders and billing claims at an academic medical center as a proof of concept pilot study.

Methods: A database of inpatient and ambulatory medication orders and clinician billing claims over 1 year (1/1/2011 to 12/31/2011) was produced. The institution was an academic urban hospital and large ambulatory center. This dataset was interrogated for likely LA/SA errors using an algorithm based on drug name similarity, the sequence of ordering and cancellation of medications, patient identifiers, and diagnostic information from clinician billing claims. The results of the detection algorithm yielded a set of patient charts in which a LA/SA error was thought to be likely. A small sample of 84 charts was reviewed by experienced clinicians (PharmD or attending physician) to determine if the drug in question based on the detection algorithm was a true error.

Results: Of the 84 charts reviewed, 5 were true errors, 4 were questionable errors and 75 were not errors. This yielded a Positive Predictive Value (PPV) of 7%. The drug pairs (ordered drug/intended drug) associated with the 5 definite errors were aminophylline/amitriptyline, caffeine/codeine, levocarnitine/levothyroxine, penicillamine/penicillin, and pyridostigmine/pyridoxine.

Conclusion: This pilot study showed that an algorithm based on drug name similarity, diagnosis, and drug order sequence was able to find LA/SA medication errors. The PPV was low in this initial analysis, but continued work should be able to raise the PPV. As the purpose of the algorithm is to find errors, the PPV does not need to be very high to still have utility for patient safety. The long-term goal in this work

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is to develop a learning algorithm which could be used both in real-time with computerized order entry (CPOE) and retrospectively to identify and/or prevent LA/SA medication errors.

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Professional Poster Abstracts

18-T

Category: I.V. Therapy / Infusion Devices

Title: Medication administration impact on fluid overload: is a paradigm shift to small volume infusions warranted?

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Purpose: Fluid overload is a serious clinical issue associated with cardiac and renal dysfunction that leads to a continuous treatment cycle to properly manage patient needs. The current model of medication delivery to patients in the US may add significantly to a patient's daily fluid intake. Small volume infusion - maximally concentrating intravenous medications for delivery via a syringe pump may reduce the risk of fluid overload, potentially improving outcomes and reducing healthcare expenditures. The purpose of this study was to describe the potential burden of illness of fluid overload and the resulting impact to US healthcare and pharmacy dispensing.

Methods: This was a descriptive retrospective cohort study of adult patients with a hospitalization that includes time in an intensive care unit (ICU), central line placement, and the administration of at least two medications from a list of commonly used continuous infusions on at least 50% of ICU days. Data was obtained from the Premier research database (Premier Inc., Charlotte, NC, US), the largest US hospital clinical and economic database representing 1 in 5 discharges in the US. The database contains information from hospital discharge files, including a patients demographics and diagnoses, as well as information on all services billed during hospitalization. For the study, a cohort of patients with fluid overload (FO) was identified, as evidenced by the use of IV diuretics on at least 50% of ICU days, along with a matched comparison cohort consisting of patients without evidence of FO (no IV diuretic use). The primary outcome of the study was total hospitalization costs per visit. Additional outcomes of interest reviewed were mortality, total and ICU length of stay, ICU costs, readmissions, and clinical diagnoses. Assuming current US standard medication concentrations were utilized within the study, the impact of maximally concentrating these drugs was also reviewed.

Results: The database generated 63,974 directly matched patients in each of the FO and comparison cohorts. The FO cohort exhibited an average of 56.7% overall higher hospital costs per visit, 48% greater ICU costs and corresponding lengthier ICU and hospital stays, in addition to a significantly higher

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mortality rate. The majority of the FO patients (94.4%) had either primary or secondary cardiac diagnoses. Conservative fluid management has been shown to be both beneficial and necessary for many patient populations, including cardiac patients. In reviewing several commonly prescribed vasoactive medications that were included within the study, considerable daily fluid savings can be achieved by using maximal concentrations described in literature. For example, at the usual dose of nitroprusside 1 mcg/kg/min for an 80 kg patient, moving from the standard concentration of 200 mcg/ml to the max concentration of 1000 mcg/ml spares 460.8 ml/daily. This considerable fluid savings could allow enhanced nutrition to be provided or prevent the need for diuresis. Should this same patient require additional medications, these fluid savings can be magnified. As medication administration may significantly contribute to a patient's daily fluid intake, a small volume infusion method shows potential to further improve a patient's fluid balance.

Conclusion: Fluid overload is associated with adverse events, negative patient outcomes and increased healthcare costs. Implementation of a small volume infusion model is an initiative that impacts all stakeholders, steps, and components of the medication delivery system. It offers a potential solution to help improve outcomes and reduce costs for hospitalized patients via conservative fluid management. Application of this model requires a paradigm shift for pharmacy medication preparation and dispensing. A prospective study is warranted to assess pharmacy workflow feasibility and the true clinical and financial impact for the US healthcare market.

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19-T

Category: I.V. Therapy / Infusion Devices

Title: Dosing considerations of intravenous iron therapy in iron deficiency anemia

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Purpose: Currently, there is no consensus regarding the most appropriate iron deficit repletion dosing for patients with iron deficiency anemia receiving intravenous iron. Many of the newer intravenous iron products recommend a total cumulative dose of approximately 1000 mg while the older preparations utilize a calculated dose based on the Ganzoni formula. The newest preparation, ferric carboxymaltose (FCM), utilizes an FDA-approved cumulative dose of 1500 mg. Here, we discuss and explore intravenous iron dosing rationale and examine the safety, efficacy and appropriateness of a higher cumulative dose of intravenous iron.

Methods: In 5 FCM calculated-dose clinical studies, the total iron deficit was determined and averaged amongst patients. A modified Ganzoni formula was utilized (subject weight in kg multiplied by [15 minus current hemoglobin (g/dL)] multiplied by 2.4 plus 500) to determine total iron deficit. This is the same methodology utilized in the calculation of the iron requirement for the iron dextran preparations. If subject transferrin saturation (TSAT) was greater than 20 percent and ferritin greater than 50 ng/mL, the 500 mg constant was to be subtracted. These clinical studies examined iron deficiency anemia (IDA) in post-partum patients, patients with heavy uterine bleeding, patients with non-dialysis dependent chronic kidney disease (ND-CKD), patients with gastrointestinal disorders, and others. In the two pivotal FCM clinical studies (not utilizing a calculated dose) that led to its FDA approval, a post-hoc analysis was performed to evaluate the patients total iron deficit. The Ganzoni formula was employed (as with the 5 clinical studies above) to calculate the total iron requirements for patients in all cohorts for study 1 and patients in all cohorts for study 2 (REPAIR-IDA trial). To investigate the adequacy of the iron dose, we investigated the proportion of subjects with a hemoglobin greater than 12 g/dL at end of treatment (Day 56) and the proportion of subjects requiring retreatment with additional intravenous iron between Days 56 and 90 in clinical study 2 (REPAIR-IDA trial). Clinical study 2 compared the efficacy of 1500 mg FCM versus 1000 mg iron sucrose. All research represented in this study was approved by an institutional review board.

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Results: The average total calculated iron deficit in the 5 clinical studies was 1527 mg. The average total calculated iron deficit for the FCM pivotal trials was 1425 mg. In clinical study 2, the proportion of subjects with a hemoglobin greater than 12 g/dL at the end of treatment was 265/1249 in the FCM group (24.4 percent) and 169/1244 in the iron sucrose group (15.6 percent) (p equals 0.001). The proportion of patients who were retreated between Days 56-90 was significantly higher in the iron sucrose arm 142/1285 (11.1 percent) than in the FCM arm 71/1276 (5.6 percent) (p less than 0.001).

Conclusion: This study indicates that a total cumulative dose of 1000 mg of intravenous iron may be less than appropriate for iron repletion across a broad range of disease states attributable to IDA. FCM, an intravenous iron FDA-approved for the treatment of patients with IDA across various etiologies, is an effective therapeutic option with an evidence-based cumulative dose of 1500 mg of iron for repletion. A higher cumulative dose (up to 1500 mg) of intravenous iron is more efficacious in patients with IDA of various etiologies.

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20-T

Category: Quality Assurance / Medication Safety

Title: PREVALENCE OF ORTHOSTATIC HYPOTENSION AS A RISK FACTOR FOR FALLS IN AN ACUTE BEHAVIORAL HEALTH CENTER AT A TERTIARY VA HEALTH SYSTEMS : A PILOT STUDY

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Purpose: The study was performed to assess the overall prevalence of orthostatic hypotension (OH) (primary) and its associations with demographic characteristics and the use of medications, especially antipsychotics in an acute behavioral health center (BHC) (secondary).

Methods: Physicians wrote orders for OH BP each morning during rounds. Nurses were trained by the nurse manager on the appropriate BP measurement techniques (per CDC guidelines Evidence-based). Per CDC: patient should be in supine position for 5 minutes, then take a resting blood pressure, then have the patient stand for a repeat blood pressure measurement at minute 1 and minute 3. Given that the veterans in the acute BHC suffer from various psychiatric conditions and therefore unstable, an OH measurement was simply taken from sitting position and then a standing position whenever a veteran was determined to be uncooperative to the CDC method. (Not Evidence-based) A decrease of at least 20 mmHg in systolic BP and/or decrease of at least 10 mmHg in diastolic BP were considered OH. Included veterans in an acute psychiatric unit who were determined to be taking at least one medication that is known to be associated with OH. Excluded veterans who were not taking a medication with known association with OH

Results: Among the 30 participants, only 5/30(17%) had their BP taken based on the CDC recommended guidelines. 25(83%) of the veterans had their BP readings taken simply from a sitting position to a standing position. Out of all the 30 veterans enrolled in the pilot study, 15/30(50%) had at least one episode orthostatic BP reading in five days. 10(67%) were 55yrs or older compared to 8(53%) with no OH, 11(73%) were Caucasians compared to 6(40%) with no OH and 11(73%) had baseline hypertension compared to 7(47%) with no OH. Among the 15 veterans with an episode of OH, 13(87%) were taking at least one form of antipsychotic medication compared to only 7(47%) of the veterans with no OH. 10(77%) of the veterans with positive OH symptoms were taking two or more form of antipsychotic medication compared to only 1(14%) of the 7 veterans without OH. The prevalence of OH appears to increase with age.

Conclusion: OH IS common in the BHC and it is associated with demographic characteristics as well as some medications. The rate of OH also increases with advancing age. It is mostly common in Caucasians, hypertensive patients, patients taking benzodiazepines, anti-parkinson medications and those taking

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two or more forms of antipsychotic medications. OH as a risk factor for falls may go unrecognized in this population due to veterans inability to tolerate the recommended method for taking OH measurement and the increased time (10-20mins) required by staff to obtain a single OH BP.

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21-T

Category: Quality Assurance / Medication Safety

Title: Optimization of best practice alerts to improve medication safety in a multi-organization health system

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Purpose: Catholic Health Partners is a multi-organization health system located in Ohio and Kentucky that is comprised of 23 acute care hospitals as well as numerous physician office practices, home health and hospices agencies, and long term care residencies. Implementation of the Epic inpatient electronic medical record (CarePATH) within all 23 hospitals began in 2010 and continues at this time. Current CarePATH live sites have joined forces to collaborate and improve the Best Practice Advisory (BPA) functionality in the electronic system in an effort to improve patient safety throughout the organization.

Methods: A multidisciplinary group led by the CarePATH Clinical Content team and with collaborative input from physicians, pharmacists, and nurses from across the system was formed. This group is responsible for reviewing currently active BPAs as well as recommending suggestions for implementation of new BPAs. The group coordinates a monthly meeting via teleconference to review this information. Suggestions for BPAs are collected from the CarePath live sites and proposed to this committee. Upon approval from the BPA work group the alert is then forwarded on to the Medical Informatics Committee as well as the Nursing Informatics Committee to gain their approval when needed. Once this is completed the alert is then built within the Epic software but not activated for end-users. Thorough testing and analysis is performed to ensure the BPA is providing its intended purpose in CarePATH. After successful testing is completed the alert is brought back to the BPA workgroup to address findings, approval, and communication of a go-live date to all sites affected. Upon implementation, a 30-day effectiveness review is completed with the results reviewed at the next BPA committee teleconference.

Results: Currently there are 87 inpatient BPA alerts and 33 ambulatory BPA alerts active within the CarePATH-live hospitals at Catholic Health Partners. A review of our Metformin-IV Contrast BPA was completed. The percentage of admitted patients with metformin administered less than 48 hours post IV contrast procedure was 58% prior to the implementation of the BPA alert within Epic. Post implementation of the Metformin IV Contrast BPA results were 38% of admitted patients were

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administered metformin. While these results suggest a reduction in the percentage of patients receiving metformin post contrast procedure there is more work that continues with this particular BPA.

Conclusion: The Best Practice Advisory functionality within the Epic software has provided a mechanism for improving patient safety within Catholic Health Partners organization.

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22-T

Category: Quality Assurance / Medication Safety

Title: Experience of pharmacy interventions in improving quality of hospital inpatient prescription

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Purpose: To analyze and characterize the inpatient prescription errors after pharmacists intervened in electronic prescribing system .The results showed how the pharmacists improving inpatients medication safety, and also as a reference to develop a computer-based monitor for improving medication safety.

Methods: A retrospective study was conducted from January 1, 2013 to December 31, 2013 at a 2600-bed, tertiary-care academic hospital in Taiwan. After pharmacist intervened those medication and made recommendation which was accepted by physician then it became a record. All data were collected and analyzed from these records.

Results: The research checked 1294376 inpatient medication order sheets across the whole year. With the help of connecting electronic medical record system, pharmacist generally used chart reviews at detecting order error. In this way, all clinical monitoring and dosage adjustments are in place when required. Of these, 3447 errors were detected, an error rate of 0.26%. The most common errors were improper dose of medicine, accounting for 35.9% of the medication errors. Among them about 19% related to inappropriate drug dosing for patients with chronic kidney disease. Confusing two medications with similar-sounding names and overdosing by combining more than one medication with similar properties accounts for up to 8 % of all reported errors. Giving the wrong drug (dosage , route) with insufficient or unavailable drug information accounted for 25.9% of the errors. Missing indication were 5.9% .Interaction between medications were 2.9 %.

Conclusion: Inpatient in a medical center may have multiple comorbid conditions and subsequent polypharmacy. This leads to a higher risk in medication safety .From those experiences, we can design computer software that give alerts to recommend dose reductions for patients with renal impairment or limitation of improper route of administration or to flash up warning messages about interactions and allergies. That can guide the physician while prescribing medication .

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23-T

Category: Quality Assurance / Medication Safety

Title: A multidisciplinary, team-based approach to medication alert optimization within a computerized order entry and verification system

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Purpose: While medication alerts can provide useful clinical decision support, ineffective or excessive alerts may lead to desensitization and subsequent alert fatigue amongst clinicians. Duke University Hospital (DUH) went live with a new computerized order entry and verification system in June 2013. Following go-live, early feedback from clinicians was that the overall volume of system-generated alerts was excessive, potentially increasing the risk of missing meaningful alerts amongst the presence of low-utility or nuisance alerts. As of August 1, 2013, clinicians were seeing a total of 0.87 medication alerts per order, with 87.2% of alerts overridden.

Methods: Due to the high volume of medication alerts noted in the weeks following go-live, the DUH Pharmacy and Therapeutics (P&T) Committee created a multidisciplinary medication alerts subcommittee consisting of physician and pharmacy representation. The subcommittee was charged with evaluating and optimizing medication alerts viewed by clinicians during the ordering and verification process. Upon its inception in August 2013, the subcommittee met monthly. Pharmacy representation included medication safety, informatics, clinical managers (adult and pediatrics), medication policy, and front-line clinical staff. Prior to each meeting, a report was generated which detailed the frequency and override rate of each individual alert seen within the order entry and verification system. Individual medication alerts (duplicate therapy, drug-drug interactions, duplicate medication, or dose) were evaluated at each committee meeting. The alerts were prioritized for evaluation based on frequency, alert severity (i.e. a contraindicated versus a moderate drug-drug interaction), override rate, whether or not the drug was a high risk medication (i.e. opioids, anticoagulants, insulin), third-party drug information sources, and the clinical experience of committee members. Once the committee reached a consensus on whether or not the alerts required removal or modification, the recommendations were brought forward for review by the DUH P&T Committee.

Results: Prior to subcommittee formation, 0.87 medication alerts per order were seen within the computerized ordering and verification system (as of August 1, 2013). Duplicate therapy, drug-drug

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interaction, duplicate medication, and dose alerts accounted for 0.24, 0.21, 0.17, and 0.16 alerts per order, respectively. The subcommittee met on six separate occasions to develop recommendations concerning medication alert modification or removal. As of February 4, 2014, the number of medication alerts per order had decreased by 42.5% to 0.5 alerts per order. Duplicate therapy, drug-drug interaction, duplicate medication, and dose alerts per order decreased by 25%, 61.9%, 52.9%, and 37.5%, respectively. Despite the reduction in medication alerts during this time, the override rate remained relatively consistent (87.2% on August 1, 2013; 85.3% on February 4, 2014). To our knowledge, there has not been any reported instance of patient harm linked to a DUH P&T Committee-approved removal or modification of a medication alert.

Conclusion: A standardized process for medication alert optimization and evaluation was implemented at DUH based on clinician feedback following go-live with a new computerized order entry and verification system. This process included the creation of a multidisciplinary subcommittee (consisting of physician and pharmacy input) charged with developing recommendations leading to the modification or removal of low-utility or nuisance medication alerts. While alerts seen by clinicians have decreased, override rates remain nearly unchanged. Alert evaluation and optimization will continue to be performed in order to reduce overall clinician desensitization and alert fatigue.

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24-T

Category: Quality Assurance / Medication Safety

Title: Detecting and predicting Adverse Drug Events using the novel trigger tool methodology

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Purpose: Hospitalised patients have up to a 30% chance of experiencing an adverse drug event (ADE). The Institute of Health Improvement (IHI) ADE Trigger Tool, has been shown to be effective in identifying and quantifying ADEs. Different methods of ADE detection identify different numbers and types of ADEs. A UK study highlighted the importance of using a portfolio of methods to maximise ADE detection in an integrated systematic way. This study aims to investigate the relationship between different methods of quantifying trigger drug usage to develop a proxy measure to predict the incidence of ADEs.

Methods: The study is being conducted on medical and surgical wards at two large London teaching hospitals. Local Research and Ethics Committee approval has been granted. Six methods will be used to quantify trigger drug usage: voluntary incident reporting, retrospective case note review using the IHI ADE trigger tool, alerts of trigger drug administration from electronic patient records and electronic drug storage cabinets, ward stock drug usage, and pharmacy supply data. The trigger drugs most specific as indicators of ADEs will be studied: calcium gluconate 10%, flumazenil, glucose 20%, glucagon, naloxone and phytomenadione. Trigger drug administration identified through electronic methods linked to individual patient data will be followed up through retrospective case note review by a team of expert clinicians (doctors, nurses and pharmacists) to confirm the occurrence of an ADE. The ADE rate determined by this method will be the gold standard against which other the methods will be compared. Statistical analysis of trigger drug data collected by each method will be used to identify a correlation between trigger drug usage and incidence of ADE to produce a reliable and reproducible proxy measure that can be used to predict ADE rate.

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25-T

Category: Quality Assurance / Medication Safety

Title: Barcoded medication preparation for chemotherapy: 3 year review

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Purpose: Accurate and efficient preparation of parenteral chemotherapy doses is critical to the safety and wellbeing of the patient. Chemotherapy doses are some of the most complex doses to prepare and have potential to cause great harm if incorrect. However, standard practice in many hospital pharmacies still includes the plunger-pullback method of pharmacist verification. This method is error-prone and wasteful since the drug has already been injected into the carrier fluid before pharmacist verification. This report describes the 3 year experience of a medium sized community hospital using barcoded medication preparation (BCMP) to help ensure accurate and efficient compounding of chemotherapy doses.

Methods: In late 2010 our pharmacy installed an IV Workflow system to process all compounded sterile products (CSPs), including chemotherapy. This system requires the technician to scan the barcode on drug, diluent and carrier fluid prior to mixing, to ensure the correct ingredients are used. The technician also captures digital images of ingredients and the syringe containing the drug, before adding to the carrier fluid. The pharmacist verifies the dose remotely from any workstation in the pharmacy. The first verification ensures the correct ingredients are being used, the second verifies the volumes added and the labeled completed dose. In our old process the pharmacist walked to the anteroom to check the drug vial being used and returned to the anteroom to check the pulled-back syringe and the completed product. The use of closed system transfer devices made it difficult to pull the plunger back to the volume injected, causing the technician to mark the barrel or write the amount of drug added on a piece of paper.

Results: For the past 3 years BCMP has given us greater assurance of accuracy, reduced our turnaround times and reduced drug waste. SAFETY During the first 12 months BCMP helped intercept chemo 28 errors, which declined the next two years to 20 and 17, respectively. The error rate has dropped from 1.5% of doses processed to 0.9% and 0.8% in the second and third years. The decline in intercepted errors can be attributed to familiarity with the system, implementation of a chemotherapy technician

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specialist and standardized compounding process dictated by the system. EFFICIENCY Total dose turnaround time averaged 54 minutes for the first 3 months and dropped to 36 minutes and 30 minutes in year two and three, respectively. Pre-BCMP turnaround time averaged 47 minutes. This gain in efficiency is largely due to faster final verification since the pharmacist is notified a dose is ready and performs this task remotely. WASTE Doses mixed incorrectly were usually discarded. BCMP intercepts errors before mixing resulting in substantial waste avoidance. Cost of avoided waste for chemotherapy doses averaged \$24,000 each of the past 3 years.

Conclusion: Once a product is removed from the manufacturers package it is no longer identifiable. Since most CSPs are clear drugs added to clear fluids, mixing errors cannot be detected after the dose is admixed. Therefore, ingredients and additive volumes must be verified before injecting into the carrier fluid. BCMP systems, whether manual or robotic, achieve this goal. The practice of pharmacy has evolved tremendously since 1970 but the manner in which CSPs are prepared and verified has changed little in most hospital pharmacies. Barcoded medication preparation should become standard practice for all CSPs, especially critical medications such as chemotherapy.

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26-T

Category: Quality Assurance / Medication Safety

Title: Medication safety: behaviors and perceptions in an adult population

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Purpose: Prescription drug abuse is a growing health concern and national reports demonstrate that 71.2% of persons who used prescription medications non-medically obtain them from friends or family, whether sold, given for free or stolen. Healthy People 2020 has initiated substance abuse goals regarding community education, and The United States Office of National Drug Control Policy suggests education, proper medication disposal, monitoring, and law enforcement as part of the national prescription drug abuse prevention plan. The purpose of this study was to collect information on behaviors and attitudes of safe handling and storage of prescription medications by adult patients. We hypothesize that a significant proportion of patients engage in unsafe behaviors regarding the use, storage and disposal of prescription medications, and such patients have beliefs or perceptions enabling unsafe activities. Study findings will serve as supporting evidence of community-based educational needs about safe use of prescription medications.

Methods: Adult patients admitted to the hospitalist service at our academic medical center beginning in January 2014 are being evaluated through a prospective, observational study. The study protocol was approved by the Kent Hospital institutional review board. Patients who were > 18 years of age shall be offered a survey instrument to assess their knowledge, behaviors and perceptions of proper prescription medication use, storage and disposal. Patients are offered the survey when their discharge is anticipated within the following 24 to 48 hours. Patients shall be ineligible if < 18 years old, unable to complete survey due to clinical status, or they are in an isolation room. Participation is voluntary and patients shall provide signed informed consent upon participation. Demographic data collected shall include age, gender, persons concurrently residing in their home, prescription medications in the home, and their primary reason for their current hospitalization. Survey questions ask participants to indicate, using a likert scale, how often they: (1) keep medications in a locked place, (2) monitor medication storage, (3) have shared their medications with someone else, and (4) had someone else share medications with them. Additional questions address what the patient does with unused medications, and, if applicable, the effect of use of shared medications and the primary reasons for sharing of medications. Data will be analyzed to determine the proportion of the population that engages in unsafe practices regarding their prescription medications. Statistical analyses will determine if any correlations between demographic

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variables and survey responses exist. Responses to questions assessing the reasons why patients engage in unsafe behaviors shall be used to direct future educational interventions.

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27-T

Category: Quality Assurance / Medication Safety

Title: Reduction of missing medications through interdisciplinary collaboration, technology, and lean management

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Purpose: Improvement of missing medication is one of the pharmacy departments performance indicators. Missing medications are defined, as medications that have been ordered for a patient and are unavailable or not located by the nurse caring for the patient at the scheduled administration time. Failure to administer a medication on time may impact on patient care and increase direct and indirect costs to the health care system. The study was conducted to determine if collaboration between the nursing and pharmacy departments, combined with implementation of medication tracking technology and utilization of Lean Daily Management (LDM) principles can improve the incidence reported missing medications at our institution.

Methods: From April to September 2013, various initiatives were implemented to reduce missing medications. In April, missing medications were reported at two nursing units LDM boards. First, pharmacy implemented use of the medication tracking technology (MedEx). Pharmacy and nursing personnel were granted access to utilize the technology in the dispensing and delivery process. Second, action plans, following a Kaizen event, utilizing LDM Principles, 5 S methods pharmacy space and medication rooms at nursing units and Standard work - standardization of delivery and storage were implemented. Additionally, 5 S methods and standardization implemented in all patient care units. Two additional nursing units included missing medications on their LDM measurement. These units and pharmacy formed a task force utilizing 5 why methodology for continued improvement. The analysis included missing medication requests sent to pharmacy by nursing via the Meditech system from March 2013 to December 2013. Primary outcome measure is change in average daily number of missing medications requests. Secondary outcome measures include 1) the effect of the Kaizen event for nursing units who participated, and 2) missing medication requests per shift.

Results: At the time of LDM was initiated, overall mean daily missing medications requests were 70.05. In June, the medication tracking technology was implemented and over all mean daily missing medications requests were 59.75, a 14.7% reduction, for the period of June to September. In

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September, the missing medications Kaizen event was conducted and LDM principles were implemented. Subsequent overall mean daily missing medications requests were 49.67, a 16.9% decline from previous measurement. At the two nursing units with LDM boards and who also participated in the Kaizen event had further reductions compared to all other nursing units (41.8 % vs. 24.2%) In order to determine if there were differences in the volume of missing medication requests per shift, a sample of 7,657 missing medications was reviewed in detail During the 1500 to 2300 shift 3,063 (44%) were requested, during the 0700 to 1500 shift, 2,680 (35%) were requested, and the 2300 to 0700 shift 1,914 (21%) were requested

Conclusion: Each facet of LDM principles, interdisciplinary collaboration and technology led to improvements in the medication distribution and delivery process. Each of these initiatives was able to decrease the amount of missing medications at our facility.

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28-T

Category: Quality Assurance / Medication Safety

Title: Improvement in adherence with Centers for Medicare and Medicaid Services medication administration regulation

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Purpose: The Centers for Medicaid and Medicare Services (CMS) established a regulation that time sensitive medications should be administered within 30 minutes of their scheduled time. Non-time critical medications should be administered within 1-2 hours per hospital policy. Administration of time critical medications that are greater than 30 minutes of their scheduled time may affect the medications therapeutic effect. Medications that are considered time critical are antibiotics, anticonvulsants, anticoagulants, insulin, immunosuppressive agents, pain medication, and medications prescribed more frequently than every 4 hours. Due to the number of medications involved, it can be difficult for medication administration to be given within their respected time frame. The objective of this study is to evaluate the improvement in adherence to this regulation due to changes in the pharmacy.

Methods: An early-late administration report is reviewed on a weekly basis. This report lists the nursing unit, drug name, scheduled date and time, and administration date and time. Drugs are evaluated to determine if pharmacy changes can improve compliance with the CMS regulation. Pharmacy changes include appropriate timing of medications, changes in the computerized physician order entry system, and pharmacy operation changes.

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29-T

Category: Quality Assurance / Medication Safety

Title: Implementation of Multi-disciplinary Medication Safety Rounds

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Purpose: The Medication Safety Committee (MSC) reviews global medication safety issues at our institution. The committee wanted to discuss medication safety practices in individual areas of the hospital by speaking directly to the bedside staff. The goal was to identify areas of improvement for each unit which could apply to the entire health-system. To achieve this goal, we implemented weekly multidisciplinary rounds rotating through all areas of the hospital. The purpose of these rounds were to provide education to staff regarding medication safety concerns, promote medication safety practices, and identify current concerns from the staff and patients.

Methods: A weekly rounding team was created that includes the co-chairs of the MSC (clinical pharmacy manager and nursing director), an informatics pharmacist, and an informatics nurse. Each week a different area of the hospital is identified and the manager of that area is notified the day prior to the medication safety rounds. Rounds last approximately 30 minutes and the goal is to discuss safety topics with at least two nurses and one patient. In lieu of rounds on the Thursday prior to the MSC, the rounding team meets to discuss an action plan for information gathered from the previous three weeks rounds. The action plan is then presented and discussed at the MSC.

Results: None

Conclusion: There have been many significant improvements since the introduction of the medication safety rounds. Examples include: AcuDose optimization, Multi-dose packaging changes, bar-code scanning improvements, smart pump alert reduction, and an increase in education of current medication safety topics.

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30-T

Category: Quality Assurance / Medication Safety

Title: Frequency of medication errors in medical prescriptions of emergency area at Mexican public hospital

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Purpose: Patients attention quality depends upon several aspects, among which we encounter medical prescription quality. Medication errors (ME) constitute a risk factor for the presence of adverse effects, being prescription errors among the more frequent ME. Few complete studies had been carried on in Mexico about this topic. In this study, we evaluated the frequency of medication errors in medical prescriptions at emergency area.

Methods: Observational descriptive transverse study to evaluate in-patients prescription sheets attending an adults emergency department of a public second and third level of attention Hospital in eastern Mexico. Sample size was calculated with a confidence level of 95% and 10% bias. ME were recorded in a format designed for this study, evaluating twenty different ME occurring in the prescription phase and one ME related to administration, then these were divided in five categories.

Results: One hundred and forty one prescription sheets were analyzed, at least one ME was found in all of them. Overall, 1,079 ME were identified by this format. Mean ME found in each prescription sheet was 8, with a rank of 1 to 24. Median and mode were 7 per prescription sheet. Most frequently identified errors were: infusion rate omission (24.2 percent), abbreviations in drug name (22 percent), illegible units (11.1 percent), administration omitting of any drug (6.4%), orthographic mistake in the prescription (6 percent), and illegible drug name (5.4 percent).

Conclusion: This study shows that 100 percent of prescription sheets analyzed contain at least one ME. This data is useful and trustworthy about the frequency and class of ME in adult emergency facilities from an open Mexican hospital, which justifies propositions and implementation of improvement techniques to prevent ME, therefore avoiding potential consequences to the patient.

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Category: Quality Assurance / Medication Safety

Title: Frequency and severity drug-drug interactions in medical prescriptions in an emergency department in a Mexican public hospital

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Purpose: Drug-drug interactions (DDI) are defined as the result of the combination of two or more drugs, in which their potency or therapeutic efficacy are modified, most of them are not convenient for the patient. In Mexico, these kind of data are too weak. We realized this project to evaluate the frequency and severity of drug-drug interactions (DDI) in medical prescriptions in an emergency department in a Mexican public hospital.

Methods: Observational descriptive transversal study was carried on. The frequency and severity of DDI in medical prescriptions in adult population were evaluated at Mexican public hospital with second and third attention level. Pharmacotherapy sheet corresponding to patients were attended at consultation and hospitalization areas at emergency department. Medical prescriptions were transcribed to another sheet that was designed specially for this study. Severity of DDI and their possible clinical implications were obtained by Micromedex 2.0 software. Sample size was calculated with a confidence interval of 95 percent and 10 percent of bias.

Results: One hundred forty one medical prescription sheets were analyzed, from which at least one DDI was observed in 29 percent of them. Overall 137 interactions were identified and classified as: contraindication (1%), severe (36%), moderate (50%) and mild (13 percent). Group of drugs identified to be more frequently involved in DDI were non-steroid anti-inflammatories (90/137), H2 receptor antagonist (25/137), and oral anticoagulants (22/137). Possible clinical implications were: electrolyte imbalance (29.4%), gastrointestinal adverse effects (19.3%), elevated bleeding risk (18.5%), cardiovascular system alterations (11.8%), toxicity of central nervous system (5.9%), and miscellaneous (15.1%).

Conclusion: The frequency of DDI found in this study was 29%, which is consistent with reports among other countries. Both, early DDI prevention and identification by databases, and integration of a

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pharmacist to the health team might be the key to reduce medication errors, thus diminishing the incidence of adverse reactions to drugs, loss of therapeutic efficacy, unnecessary prolonged length of in-hospital stays, health service costs, among other consequences.

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33-T

Category: Quality Assurance / Medication Safety

Title: Implementation of medication safety self assessment (MSSA) at county general hospital Kakamega , Kenya

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Purpose: An effective health system requires safe and appropriate use of medications. However, It has been shown by different studies that medication errors occur in all health care systems when human and system factors interact to produce an unintended and potentially harmful outcome. The objective of the MSSA was to conduct a medication use process assessment using a standardized tool to examine current practices and identify opportunities for improvement. The assessment was conducted at the county General Hospital, Kakamega between April and June 2013.

Methods: The Medication Safety Self Assessment (MSSA) is a proactive rapid diagnostic systems approach of examining the entire medication use process using a standardized tool to compare existing practices against established safe medication practices. We adapted to our local context the Institute of Safe Medication Practices (ISMP) tool with self assessment practices that have successfully been applied in the US, Canada, Spain and Australia. The data collection was done by a multidisciplinary team through focused group discussion with selected hospital staff. This involved rating of the current practices against established safe medication practices in the adapted tool. Analysis was done to establish strengths, weakness and opportunities for improvement.

Results: From the assessment it was inferred that potential areas for improvement are in handling of patient information, access to drug information, medication storage practices, labeling of medications, enhancement of the newly implemented computerized system, staff education, patient education and change of culture to learn from medication errors.

Conclusion: The application of the systems approach was an eye opener to understanding the medication journey at the hospital including the interaction between various actors and processes. A number of challenges can be addressed through increased involvement of pharmacy staff within the hospital.

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34-T

Category: Quality Assurance / Medication Safety

Title: Development and implementation of a medication shortage dashboard tool

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Purpose: The increase in the number of medication shortages over the last few years has been an ongoing struggle for all healthcare providers. Common reasons for drug shortages are manufacturing delays, increased demand, raw material shortage, and Food & Drug Administration (FDA) recalls. Keeping up with the changing medication shortage landscape, as well as communicating these changes, can be very challenging for the pharmacy department. Not only does the pharmacy department need to stay current, the physicians and nurses who are the first line of medication selection need to as well. A delay in treatment, due to a shorted medication, can result in a significant risk to patient safety.

Methods: A team was formed to identify a method of communicating medication shortages to the entire clinical healthcare staff of a community hospital. First, gaps in the communication process were identified and a standardized approach to identifying medications that were at risk of becoming short in supply was developed. Next, the team created a mechanism that would both track supply on-hand, and forecast stock-outs. Finally, a dashboard, which housed all relevant medication shortage information, was developed along with a method of distribution to clinical hospital staff. The dashboard included detailed information, in a concise format, that included the following: drug name, strength, form, allocation method, reason for shortage, current supply on-hand, alternative treatment options, original report date, and projected release date. A color code was also provided to display current supply conditions and significance of shortage. The creation of this dashboard was identified as a solution to the communication gap.

Results: The completion of the goals identified by the team led to a robust instrument for identifying and communicating drug shortages. A medication shortage dashboard was developed that improved the following areas: 1) timely identification, 2) tracking supply on-hand, 3) informative data collection, and 4) timely communication of shorted medications. The improved communication led to increased visibility throughout the organization. The medication shortage dashboard became a standing agenda item for several house-wide committees, including Pharmacy and Therapeutics, Medical Executive, Antimicrobial Stewardship, and many nursing-related committees.

Conclusion: The development of a dashboard was a key component of facilitating better communication around medication shortages. Once a dashboard is developed, it can be easily maintained on a weekly, monthly, or quarterly basis and distributed to all stakeholders in a timely manner.

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35-T

Category: Quality Assurance / Medication Safety

Title: Incidence of incorrect prescribing of nitrofurantoin formulations and impact on clinical outcomes

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Purpose: Differences in nitrofurantoin dosage forms change the characteristics of the antibiotic and dictate dosing frequencies necessary to achieve therapeutic success. Specifically, nitrofurantoin macrocrystals (Macrocrystals) should be dosed every six hours for efficacy, whereas nitrofurantoin monohydrate/macrocrystals (Macrobid) is intended for twice daily administration. Pharmacy staff at the St Vincent Joshua Max Simon Primary Care Center (PCC) in Indianapolis, IN, noted repeated instances of nitrofurantoin dose frequency to dosage form discordance when dispensing. There is a lack of published information about this type of error so the frequency and clinical relevance remain unknown. The purpose of this study was to determine the frequency of nitrofurantoin prescribing errors related to a dose to dosage form mismatch at the PCC, and to analyze the impact of such prescribing errors on the successful treatment of urinary tract infection.

Methods: This institutional review board approved study was a retrospective chart review evaluating nitrofurantoin prescribing patterns of the medical residents and staff at the PCC. A prescribing error was considered to have occurred when there was discordance between prescribed dosage form and dosing frequency. Treatment failure was determined by the need for additional antibiotic treatment in patients with documented nitrofurantoin-sensitive pathogens. Active patients of the Internal Medicine (IM), Family Medicine (FM), Internal Medicine/Family Medicine (IM/FM), or Obstetrics/Gynecology (OB/GYN) residency programs were included if they were prescribed either form of nitrofurantoin between January 2009 and June 2013. Patients were excluded if they were less than 18 years of age, incarcerated, or were receiving a prophylactic dose of nitrofurantoin. The primary outcome was the concordance between prescribed dosage form of nitrofurantoin and dosing frequency. The secondary outcome was number of patients requiring an additional antibiotic to treat the infection. Demographic data regarding the patient's pregnancy status and the prescriber's training discipline were collected to assist in subgroup analysis. Statistical analysis was performed in accordance with the type of variable being analyzed.

Results: An electronic health record query identified 683 prescriptions for nitrofurantoin dosage forms during the study period. Of 460 nitrofurantoin prescriptions that met inclusion criteria, 65 (14.1 percent) contained a dose to dosage form mismatch. Of these, 53 resulted in a potential under dose (81.5

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percent) and twelve resulted in a potential overdose (18.5 percent). Eleven of the fifty-three patients who were under dosed (20.8 percent) required repeat antibiotics within 30 days, despite culture results demonstrating bacterial sensitivity to nitrofurantoin. OB/GYN wrote the highest number of nitrofurantoin prescriptions overall (n equals 182), followed by FM (n equals 160), IM (n equals 54), IM/FM (n equals 53), and other (n equals 11). The IM error rate (27.8 percent) was significantly higher than both FM (15 percent) and OB/GYN (9.9 percent) (p equals 0.04 and p equals 0.003 respectively), and was greater than IM/FM (11.3 percent), trending towards statistical significance (p equals 0.05). A total of 191 (41.5 percent) of the 460 prescriptions were prescribed to pregnant patients, including 16 which were written inappropriately. All prescribing errors involving pregnant patients resulted in a potential under dose, with five (31 percent) of these patients requiring an additional course of antibiotics.

Conclusion: Prescribing errors involving dose to dosage form mismatches with nitrofurantoin occur with alarming frequency and may result in treatment failure. Education and system-based changes designed to target this group of errors are important to ensure that patients receive appropriate antibiotic therapy. Pharmacists can play an integral role in assuring correct prescribing of Macrobid or Macrodantin.

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Category: Quality Assurance / Medication Safety

Title: Risk stratification of chemotherapy and hazardous medications: multidisciplinary process for safety

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Purpose: The avoidance of errors throughout the medication-use process for chemotherapy and hazardous medications is an important component of the institution's medication-use safety initiatives. This project was designed to assess the current policies and develop a standard work process with recommendations for differentiated safeguard requirements for specific medication groups/classes based on the potential to cause harm.

Methods: A multidisciplinary task force consisting of pharmacists, nurses and physicians was formed, assessed the pharmacy and nursing chemotherapy policies and analyzed the perceived problems associated with the chemotherapy/hazardous process steps. Root cause analyses of several incidents involving chemotherapy/hazardous medications errors were conducted to further identify contributing factors. Policies restricted the prescribing of chemotherapy/hazardous agents to oncology attending physicians, via a paper chemotherapy ordering process, whom only the oncology pharmacists may verify and the administration of the medication by an Oncology Nursing Society (ONS) chemotherapy/biotherapy trained nurse regardless of the indication, service or location. A conceptual model was developed that categorized medications by cancer and non-cancer indications and the risk level at each step (ordering, consenting, verification, preparation and administration). Effective safeguards were identified based on both the indication and medication risk. An electronic database reference was developed to support the granular details for each chemotherapy/hazardous medication, associated indication and required safeguards. An enterprise policy was developed based on the conceptual model and replaced the previous chemotherapy nursing and pharmacy policies. Computerized physician order entry (CPOE), pharmacy verification and electronic medication administration record (eMAR) functionality was developed that hardwired ordering privileges and reinforced the required safeguards. The enterprise policy, database, and electronic functionality were endorsed by the Pharmacy and Therapeutics (P&T) committee and have been implemented. Post implementation monitoring is ongoing.

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Results: A conceptual model was vetted by medical, pharmacy and nursing leaders and endorsed by the P&T committee prior to the development of the enterprise policy and database. The conceptual model differentiated the various standardized safeguards required. The online database detailed over 160 medication/indication combinations with the associated standardized safeguard at each step (ordering, verification/preparation and administration) based on indication and risk. The resulting safeguard standards defined included: ordering privileges for chemotherapy (cancer indication) are restricted to oncology attendings; hazardous medications (non-cancer indication) are restricted to non-oncology attendings. Ordering High Risk medications require a paper order until an approved order set with programmed safeguards is implemented; whereas ordering Low Risk medications is allowed for individual electronic drug item ordering. Pharmacist verification/preparation for High Risk medications is restricted to oncology pharmacists; Low Risk medications allows for licensed pharmacists verification. Administration for all chemotherapy (cancer indication) and high risk hazardous medications requires chemotherapy/biotherapy trained nurse with double check; Low Risk hazardous medications can be performed by a licensed registered nurse with double check. Post implementation feedback from end users identified a few programming discrepancies but overall has resulted in improved ordering and administration workflow and fewer medication errors associated with chemotherapy/hazardous medications reported.

Conclusion: Restrictive safeguards applied to all chemotherapy/hazardous medications can result in unnecessary workflow challenges. Standardized but differentiated safeguards were applied to medications based on the medication indication, medication use process step and risk level. An online database and electronic CPOE and eMAR functionality were utilized to reinforce practitioner compliance. This standardized but differentiated approach was helpful in creating a safe and effective medication use process for chemotherapy and hazardous medications.

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37-T

Category: Quality Assurance / Medication Safety

Title: Developing an inpatient insomnia order set: getting back to the basics

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Purpose: Many factors contribute to sleep problems for hospitalized patients, yet little guidance exists for how to manage them. Medications used for sleep are often associated with undesirable effects such as residual sedation and patient falls. Providers in our 329-bed institution prescribed nearly 11,000 orders for over 7,000 patients for insomnia management in 2013. Medications included zolpidem, trazodone, diphenhydramine, and various oral benzodiazepines. Zolpidem is currently included on our general medical admission order set and most surgical and orthopedic order sets. This project was designed to develop an inpatient insomnia order set focusing on nonpharmacological nursing strategies with limited pharmacological options.

Methods: In response to patient fall data presented at the Medication Safety Subcommittee (MSSC), committee members searched for and reviewed treatment guidelines, review articles and established protocols related to the management of inpatient insomnia. Alternatives to zolpidem were also researched. The limited relevant findings were used by a team of two pharmacists, two physicians and the medication safety fellow to draft an Inpatient Sleep Protocol. The protocol and a formulary drug evaluation for zaleplon were presented at and approved by MSSC and the Pharmacy and Therapeutics (P&T) Committee. A hardcopy Insomnia Order Set Doctors Order form was created from the protocol. The form was subsequently approved by the Forms Committee, Nursing Practice Council, and P&T. The order form was then converted to an electronic order set for use with computerized physician order entry.

Results: The Inpatient Sleep Protocol/Insomnia Order Set includes many nonpharmacological nursing sleep promotion strategies that target the reduction of noise, light, interruptions, anxiety, and consumption of food and drink in the evening hours. If the patients sleep problem continues after two overnights of implementing the nonpharmacological nursing sleep promotion strategies, providers are prompted to assess the patient for potentially modifiable risk factors related to insomnia, such as sleep-disturbing medications or conditions. Pharmacological management of insomnia may be initiated if

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deemed appropriate by the provider and includes either zaleplon or zolpidem. Providers are guided to the appropriate initial agent based on timing of administration and the appropriate initial dose based on age and gender. The Protocol/Order Set provides alternative recommendations if the initial regimen is ineffective. Patient education is recommended with every pharmacological option.

Conclusion: An inpatient insomnia order set was developed that promotes nonpharmacological sleep strategies prior to initiating pharmacological management.

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Category: Quality Assurance / Medication Safety

Title: Medication safety culture: development of a tool for use in United Kingdom (UK) hospitals

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Purpose: The use of medicines is the most frequent intervention amongst all health care interventions. Medication incidents are the second most commonly reported incident type in UK hospitals. Developing a culture of safe medication use is a key component of improving medication safety outcomes and preventing incidents. A better understanding of safety culture specifically related to medication management is important to improve medication safety. Numerous tools have been developed to measure patient safety culture in healthcare settings. There are currently no known validated tools to measure medication safety culture. We propose to therefore develop a tool to measure medication safety culture.

Methods: University Research Ethics Committee and the hospital Research department approval will be sought. A literature search will identify validated patient safety culture tools available. Tools will be adapted to assess medication safety culture. The questionnaire developed will be reviewed by an interdisciplinary medication safety expert panel, then piloted and converted to an online tool. Participant demographics collected will include age, gender, number of years in the hospital. Medication safety attitudes and perceptions measured will include working environment, team work, management of medication errors, stress recognition and management attitude to medication safety. Medical and dental staff; pharmacists and pharmacy technicians; nursing, midwifery and operating department practitioners in one UK teaching hospital will be surveyed anonymously to maintain confidentiality. The primary endpoints will be the development and psychometric analysis of the medication safety culture tool. The secondary endpoint will be to determine the overall medication safety culture of health professionals involved with prescribing, dispensing, administering and monitoring medication. Descriptive statistics will report respondent demographics. Means, standard deviations and interim correlation matrix will be computed for each item. Cronbach's alpha will be calculated to measure the internal consistency reliability. The construct validity will be determined by confirmatory factor analysis and model fit indices.

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Category: Quality Assurance / Medication Safety

Title: Pyxis count discrepancies: nurse training to reduce discrepancies

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Purpose: Automatic dispensing cabinets (ADC) have improved medication safety and access, but may have unintended consequences. ADC discrepancies are differences between the actual and expected count of a medication. They can result from benign processes or patient safety concerns, and current monitoring reports do not differentiate between the two. The purpose of this investigation was to train nurses to reduce discrepancies resulting from benign processes. Reducing discrepancies from benign processes would allow a report of discrepancies to better identify possible patient safety concerns.

Methods: In this prospective investigation at a large academic medical center a pilot unit was selected for training. Nurses were first educated with an iPad module. Afterward, a new, unique method of hands-on standardized ADC training and just in time training (JITT) was provided to the nurses. Specific case scenarios were created collaboratively with a nurse masters student to target issues identified by continuous quality improvement that potentially result in a benign ADC discrepancy. Discrepancy data was collected through the ADC central server. The rate of discrepancy creation was compared to a control period on the same unit, just prior to training. An unpaired Students t-test was used for the analysis of discrepancies, and was tested for autocorrelation to validate the results. A satisfaction survey, including respondent demographics, was given immediately after training. Responses were recorded on a Likert scale of 1-5, with 1 being strongly disagree and 5 being strongly agree. Descriptive statistics were used for the satisfaction survey results.

Results: Ninety-four percent of nurses were trained, and 94% of the trained nurses completed the survey. Demographics showed that 75% of nurses were female, with 85% being 31 years or older. About one third (38%) have 1-10 years of nursing experience, while 57% had 11 or more years experience. Self-reported level of ADC expertise was 43% as intermediate and 53% as expert. Survey responses showed a mean score for case scenarios as follows: pertinence to work setting (4.65); efficiency of training (4.63); and appropriate difficulty level (4.57). Survey responses regarding the ADC training machine showed a mean score of: ease of use (4.75); usefulness as a teaching tool (4.75); usefulness for in-depth training

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(4.60); and, usefulness for quick content review (4.58). Survey responses regarding the satisfaction with the flip cards had mean responses of: professional appearance (4.53); usefulness (4.15); and, ease of daily use (4.13). All responses ranged from 1-5. The rate of discrepancies per transaction per day decreased from 0.00866 to 0.00744 ($p = 0.368$) after the intervention.

Conclusion: The survey results show an overall high level of satisfaction with the hands-on training method, use of a training Pyxis machine, and the JiTT. While the training was well received, there was not a statistically significant decrease in the rate of discrepancies. This may be explained by the short duration of the study or the high level of self-reported expertise on using the ADC in the pilot unit. Future work will include continued trending of the rate of discrepancies in the pilot unit. If a downward trend continues and becomes significant, this training method may be used as a tool throughout the hospital.

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40-T

Category: Quality Assurance / Medication Safety

Title: Syringe pump infusions in the neonatal intensive care unit: optimizing smart pump technology

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Purpose: Intravenous (IV) meds are associated with 54% of potential adverse drug events (ADEs), with errors of administration more likely to reach and harm the patient. Potentially life-threatening IV medication errors occur every 2.6 days. Smart infusion pumps and their dose error reduction software (DERS) can help prevent IV medication errors; however, programming infusions in basic mode bypasses the safety features available on smart pumps. The data the smart pumps automatically record can guide quality improvement and determine the pumps impact on improving patient safety. Lean Six Sigma methods provide a framework for evaluating the safe and effective use of smart pump infusion technology using the DMAIC (Define, Measure, Analyze, Improve, Control) cycle. Using the DMAIC cycle we sought to improve the safe use of smart syringe pumps used to infuse medications in the neonatal intensive care unit (NICU) at a large university hospital.

Methods: Three areas for improvement were defined: safely using the smart infusion pumps with improved rate of programming in DERS; determining medications that lacked library entries; and, presenting and regularly reviewing the data collected during smart pump infusions. We measured our baseline performance using two methods. To describe the use of syringe pumps on the NICU the medical records of all patients with a syringe pump in use during a five day period were reviewed. Analysis of this information showed that 90 infusions were run in basic mode while 125 were run in DERS. Ten unique medications were identified as being infused with programming in basic mode. In addition, a technology satisfaction survey was emailed to all NICU nursing staff. This survey revealed that the top four nursing concerns were: not all medications being available in the library; alarms sounding too frequently; issues with slow or low infusion rates specific to this patient population; and, pump size.

Results: Once the initial investigation was complete, three changes were implemented. First, a committee was formalized and now reviews pump safety data on a monthly basis. Next, nurses on the NICU were educated on the importance of using DERS infusions and were presented with the units compliance rate. Finally, a library update request was made for changing existing medication library entries that frequently encounter programming issues, and to add entries for medications that currently

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do not have them. With implementation of the first two changes, we have seen a statistically significant increase in the rate of DERS programming after four months. The results thus far are likely due to increased awareness of the importance of using DERS programming, having access to useful data at the point of patient care, and optimizing the programming settings used for this patient population.

Conclusion: The most important step for ensuring that our results are controlled in the future was establishing a committee with a charter and mission that would support the regular review of pump safety data. This committee also provides the expertise to guide changes in the use of smart pumps hospital wide, through a multidisciplinary constituency. By integrating the views of frontline nursing staff, the concerns of those most affected by the use of this technology are being addressed, along with the systematic review of the pump library medication entries. In the future, the DMAIC cycle used to increase DERS compliance in the NICU will be used in other nursing units and likely will be used for other types of smart infusion pumps. In addition, the committee will continue to review smart infusion pump safety indicators for new patient safety concerns and areas for improvement.

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Category: Quality Assurance / Medication Safety

Title: Optimization of factor product utilization within an academic medical center

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Purpose: Safe and appropriate utilization of coagulation factor products is of significant importance. The existence of multiple factor formulations poses risk for error in addition to increased drug expenditures. Currently within the University of Virginia Health System (UVAHS), guidelines have been developed for various factor products which permit only certain services to order these agents for select indications. A process does not exist, however, to enforce these ordering restrictions. Opportunity also exists for improvement surrounding the dispensing and administration of factor products throughout the institution. Factor products are consistently within the top 10 drugs in expenditure at UVAHS which amounted to \$3,000,000 in fiscal year 2013. This spend has continued to grow from \$1,500,000 in fiscal year 2012 and is expected to exceed \$6,000,000 in fiscal year 2014. The purpose of this project is to implement improved systems surrounding factor product ordering, dispensing, and administration in order to enhance medication safety and streamline utilization.

Methods: This project will not require approval by the Institutional Review Board. This project will consist of three stages impacting various areas of the medication use process, including ordering, dispensing, and administration. The first stage will consist of optimization of the ordering of factor products per institutional guidelines. An educational module will be developed to restrict ordering of these products to approved services only. Following completion of the module, only those approved providers will be granted ordering privileges for factor products in the electronic medical record (EMR). The second stage will require modifications to the dispensing of factor products. Rather than send medication vials to the patient care units where additional manipulation will take place, factor products will be compounded within the sterile environment of the IV room. The final stage will involve the development of multidisciplinary educational resources to provide clarification regarding coagulation disorders and administration of factor products, including proposed dosing regimens. Efficacy of the implemented changes will be assessed through analysis of drug spend, factor product waste, and adherence to guideline restrictions.

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43-T

Category: Quality Assurance / Medication Safety

Title: Application of global trigger tool versus voluntary reporting of harm from drug adverse events detection, root cause analysis and prevention

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Purpose: Drug adverse events (AE) in hospitalized patients can increase length of stay, cause morbidity, and rarely even mortality. Voluntary reporting (VR) can be sporadic and foster recurrences. A more systematic approach to AEs is a global trigger tool (GTT), that samples discharged patient, on a monthly bases, for AEs and projects overall harm rate for total patient population. The purpose of this study was to contrast GTT and VR in a tertiary care hospital over a 24 month period for numbers, severity, and rate of harm. Furthermore, the goal was to apply this information and adjust policy to limit or prevent recurrence of problematic areas and to apply the data for the development of specific safety initiatives with a goal to decrease patient harm by 40% over a two year period.

Methods: GTT method briefly involves screening by trained GTT reviewers, consisting of a pharmacist and nurse, of 20 patient charts monthly. The process is limited to a 20 minute review of each, looking for triggers such use of naloxone, glucagon, flumazenil, etc. that can alert screeners to AEs evaluated for harm. These are extrapolated to harm per 1000 patient days of hospitalization as defined by Institute for Healthcare Improvement (IHI). Harm determination is based on the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) formula. Harm severity scales are alphanumeric A-I for GTT vs 1-8 for VR (note A-D, 1-3, respectively represent no harm). In this study GTT was compared to AEs reported via VR over a 24 month period for 2012 through 2013. Each AE was then evaluated for root cause analysis through Institute for Safe Medication Practices (ISMP) Assess-ERR worksheet to assess problematic areas. Subsequently, evaluations of institutional policies were reviewed for changes that could prevent or limit recurrences.

Results: GTT identified AEs in 13.26+/-4.3% of the 20 charts reviewed each month. Over the study period, total AEs of harm for VR was 68 (2.8+/-1.0/month) while GTT identified 80 (3.3+/-1.2/month), $p=0.56$. However when extrapolated to harm per 1000 patient days, the mean rate per month for VR was 0.25+/- 0.11, vs 42.45+/-23.61 for GTT. Using GTT trended data 3 AE problem areas were identified for further focus. These were patient over-sedation, opioid administration, and insulin-associated hypoglycemia. These areas were trended for AEs for 2011-2013, from GTT data, and demonstrated harm rates per 1000 patient days of 3.8, 1.2, 4.6, respectively.

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Conclusion: Although AE total numbers for GTT and VR were comparable in this study, extrapolated harm per 1000 patient days was vastly different in a magnitude similar in other studies. VR requires staff to dedicate time to AEs at the cost of other patient care issues that are equally important and therefore AEs are not prioritized. GTT provides a more comprehensive and systematic approach that allows institutions to guide patient safety initiatives, which has not been shown to be possible via VR. Following up this system with root cause analysis allows institutions to develop policies that can minimize recurrences and enhance patient safety. Alternatives such as computerized systems and use of dedicated staff for intensive monitoring of AEs are labor-intensive and require greater resources and technical training, that is often not possible for smaller institutions. GTT can be instituted with limited initial training and reasonably short monthly survey times, which can identify problem areas that may continue to be medication safety issues for patients if a systematic approach such as GTT is not utilized.

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44-T

Category: Quality Assurance / Medication Safety

Title: Use of a best practice alert to curb inappropriate duplicate pneumococcal vaccinations

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Purpose: In California, state law mandates that hospitals offer pneumococcal vaccines to all patients prior to discharge. To facilitate compliance, the health systems computerized physician order entry (CPOE) incorporates prompts in the discharge order set to remind all providers to vaccinate. The purpose of this project was to determine the prevalence of inappropriate duplicate pneumococcal vaccines at the medical center, implement a plan to decrease the number of duplicate pneumococcal vaccinations, and to evaluate the effectiveness of this process improvement.

Methods: A medication database was reviewed to identify all patients discharged between the dates of April 1, 2011 through August 20, 2012 who had received more than one pneumococcal polysaccharide vaccine (PPSV23) during the defined period of time. Patients were excluded if revaccination was appropriate according to the CDC guidelines. A best practice alert (BPA) was implemented in the beginning of August 2012 to warn the inpatient validating pharmacist and ordering physician to check for inappropriate duplicates when processing new pneumococcal vaccine orders. Specifically, the best practice alert included a link to the immunization record and appeared upon verification for every pneumococcal vaccine order. In addition, an electronic notification was distributed to inpatient pharmacists educating them on which patients should receive duplicate PPSV23. Health system pharmacists were granted the authority to discontinue inappropriate duplicate vaccines without having to contact the prescriber. One year after the best practice alert was implemented; the medication data was reviewed again to determine the number of duplicate pneumococcal vaccines that were discontinued by pharmacists and providers between the dates of August 22, 2012 to August 21, 2013.

Results: There were a total of 185 inappropriate duplicate PPSV23 immunizations that were administered to patients before the best practice alert was implemented. The total cost of inappropriate duplicate immunizations was \$21,175.10. There were a total of 905 pneumococcal vaccines that were discontinued between August 22, 2011 and August 21, 2012. The breakdown of discontinuing specialties is as follows: pharmacists 791/905 (87%), medical residents 79/905 (9%), attending 20/905 (2%), physician assistants 6/905 (0.7%), nurses 3/905 (0.3%), nurse practitioners 2/905 (0.2%), midwives 2/905 (0.2%), medical fellows 2/905 (0.2%). Post best practice alert, there were a total of 7 inappropriate

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duplicate pneumococcal immunizations between August 22, 2012 and August 22, 2013. The total cost of inappropriate duplicate immunizations was \$801.22. There were a total of 1367 PPSV23 discontinued between August 20, 2012 and August 20, 2013. The breakdown of discontinuing specialties is as follows: pharmacist 1282/1367 (94%), medical resident 58/1367 (4%), attending 14/1367 (1%), medical fellows 5/1367 (0.4%), nurses 3/1367 (0.2%), nurse practitioner 3/1367 (0.2 %), midwife 2/1367 (0.1%). One year after implementing the best practice alert, there was a 96% reduction in number of duplicate PPSV23 given to patients at the medical center and a cost savings of \$20,373.88.

Conclusion: The best practice alert was an effective and efficient way to prompt the pharmacists to review the immunization record prior to verification. Including a link to the immunization record may also have helped to increase compliance to CDC pneumococcal vaccination guidelines. Granting pharmacists the authority to discontinue duplicate vaccines may also have aided in increasing compliance with minimal impedance on the pharmacists workflow.

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45-T

Category: Quality Assurance / Medication Safety

Title: Trends in antidepressant-related adverse drug events in hospitalized patients from 2001 to 2011 in the U.S.

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Purpose: The rates of adverse drug events (ADEs) are increasing over time mainly due to the aging of the population and the growth in the number of comorbidities and polypharmacy. Depression is a prevalent mental disorder and the 4th leading cause of disability in the world as per the World Health Organization. Use of antidepressants can lead to ADEs. This study aimed to examine changes in incidence of antidepressant-related ADEs (ArADEs) in hospitalizations from 2001 to 2011 among different demographic groups and types of hospitals; and to examine changes in lengths of stay (LOS) and hospital charges in ArADE-related hospitalizations from 2001 to 2011.

Methods: The institutional review board approved this study based on de-identified database. The Health Care Utilization Project database, which covers more than 1000 hospitals in 45 states, was used. Weights of individual inpatient stays provided in the database were used to estimate the national total. ADEs included harm caused by a drug at normal doses, medication errors, and other harms caused by use of a drug. Illicit drug use and cases of intentional harm or self-inflicted injury were excluded. Primary diagnoses of ArADE were considered as an indicator of ADE-caused admissions and secondary diagnoses as a proxy for hospital-acquired ArADEs. ArADEs in different demographic groups were examined including age, race, gender, and rural/urban hospitals. Age was categorized into 0 to 6, 7 to 17, 18 to 64, and 65 years or older. LOS and hospital charges for ArADE-related cases were compared between 2001 and 2011. Chi-square test and t test were used with $\alpha=0.01$.

Results: There were 17,375 and 20,588 ArADE-caused admissions in 2001 and 2011, respectively. There was a 20.4% increase among the group of 18 to 64 and a 68.2% increase among the group of 65 years or older ($p<0.01$) and no significant change in the other age groups. Both gender groups had a similar increase. The mean LOS increased from 2.19 to 2.80 days ($p<0.01$). Mean hospital charges increased from \$8,559 to \$21,599 ($p<0.01$). There were 24,633 and 22,626 hospital-acquired ArADEs in 2001 and 2011, respectively. There were 67.2% decrease among the groups of 0 to 6, 13.8% increase among the group of 18 to 64 and 76.6% decrease among the group of 65 years or older ($p<0.01$). Both gender

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groups had similar decrease. There were 30.8% decrease in rural hospitals and 7.3% decrease in urban hospitals ($p<0.01$). The mean LOS decreased from 4.11 to 3.67 days ($p<0.01$). Mean hospital charges increased from \$10,137 to \$21,338 ($p<0.01$).

Conclusion: There was an increase in ArADE-caused admissions and a decrease in hospital-acquired ArADEs. The great increase in ArADE-caused admissions among elderly patients should be noted and addressed by practitioners and policy makers. The great increase in hospital charges needs further research.

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Category: Quality Assurance / Medication Safety

Title: Pilot Survey: Global Assessment of the Advancement of Hospital Pharmacy Practice According to the International Pharmaceutical Federation (FIP)'s

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Purpose: A survey to assess an international hospital on their level of hospital pharmacy practice according to the Basel Statements was piloted and validated.

Methods: Basel statements which could be assessed and measured at the hospital level were included in the survey instrument. Constructs were revised after five cognitive interviews with likely participants. The survey instrument was pilot tested in four countries; two high income, a lower middle income, and a low income country. Basel Statement Tiers were developed by investigators to assist hospitals in prioritizing the achievement of Basel Statements. Tiers were validated by the Hospital Section chairs of FIP through a card sorting exercise. Simple agreement was used to characterize inter-rater reliability. Descriptive statistics were used to characterize the responses.

Results: Forty-four survey responses from 36 hospitals were collected. The survey response rate was 29% and took an average of 26 minutes to complete. The overall average agreement of constructs was 83%. The survey characterized how far a hospital was to achieving the Basel Statements with an average achievement rate of 57% (ranging from 30% to 90%). The survey highlighted medication safety challenges facing the pharmacy profession. The results produced a bench marking report for each respondent.

Conclusion: The practice of hospital pharmacy differs within countries. The validation of this survey provides a tool for hospitals to track their Basel Statement progress and benchmark their practice. This survey should be adopted by FIP to disseminate globally and create a global dashboard for hospital practice.

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47-T

Category: Quality Assurance / Medication Safety

Title: Effects of visual cues in accuracy of pharmacist product check

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Purpose: Often times, the pharmacy department and its medication dispensing functions are physically segregated from patient care areas. Many tasks associated with dispensing medications are routine procedures that are repeated throughout the day. One important duty for an inpatient pharmacist is to check the accuracy of medication orders that have been filled for patients prior to the medications leaving the pharmacy for delivery to nursing units. Despite diligence and effort, there are inevitably occasional orders that may have been filled incorrectly and escape detection by the checking pharmacist. The purpose of this study is to identify if there is a difference in the accuracy of pharmacists performing a final check of medications when there are images of patients located close to the checking station compared to when there are no patient images posted. The null hypothesis of this study is that the presence of rotating patient photographs near the product checking station will not result in more accurate pharmacist product check and that there will not be a reduction in products with undetected errors leaving the pharmacy.

Methods: Data from this IRB approved study will be collected over a period of ten weeks to identify the rate of undetected errors that are dispensed by the pharmacy. Data collection will consist of counting total number of doses checked (denominator) and total doses with at least one undetected error (numerator). Posting a patient picture or having no picture will be alternated weekly over a ten week study period. Hanging or removal of photos will occur on Friday evenings. Data will be collected Monday through Friday to allow a washout period over the weekend. Data will be collected and recorded on the nursing unit after doses have been checked by a pharmacist and delivered by a technician. The inclusion criteria for this study includes unit dosed or ready to use products dispensed by the pharmacy. Exclusion criteria include doses filled on the weekend, or doses that are not ready to use products. Data from the picture weeks will be compared to no picture weeks using a chi-square test.

Results: Data will be used to calculate a weekly error rate. Descriptive information on undetected errors was also collected, including: the nursing unit where the medication was ordered, the relative

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experience level of the pharmacist checking the medication, and the type of error that occurred (eg, wrong drug, expired product, missing auxiliary label, etc.). The rate of undetected errors during weeks with patient photos will be compared to the rate of undetected errors when no photos were hanging to determine if this environmental change had an effect on the pharmacists ability to detect medication errors.

Conclusion: Conclusions will be made available after results have been analyzed.

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48-T

Category: Quality Assurance / Medication Safety

Title: Evaluation of the Quality of a Pharmacy Residency Assessment Program

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Purpose: In order to provide quality service, healthcare providers must have the competencies necessary to perform their jobs according to standards. There is a growing emphasis on the demonstration of achieved competency through outcome measures for healthcare professionals as opposed to experience-based training. In this transition towards assessment of competencies, understanding the quality of an assessment method and its criteria plays a key role. The purpose of this study was to evaluate the residency assessment program for pharmacy residency programs at UNC Hospitals and Clinics (UNCH).

Methods: A Competency Assessment Program self-evaluation tool created and validated by Baartman and colleagues¹ was adopted, reviewed, and administered as a web-based self-evaluation tool to pharmacy residents enrolled in the program between 2010 and 2013 (n= 41) and current preceptors (n= 53) at UNCH. The self-evaluation tool is a web-based survey which includes 4 indicators for 12 quality criteria. Survey respondents were also asked to identify the assessment methods utilized during their residency or precepting experience through the residency assessment program at UNCH. Utilizing IBM SPSS version 21, a reliability analysis was performed using Cronbachs alpha, and the survey results were then analyzed using descriptive statistics and non-parametric analytic methods. Baartman and colleagues regarded criteria rated at 65% or higher to be of good quality, ratings between 30% and 64% to be of medium quality, and ratings below 30% to be poor. Results were reviewed by the research team, who then made recommendations on improvement in the assessment program for pharmacy residents at UNCH.

Results: 23 residents and 28 preceptors completed the survey tool, corresponding to a 56.1% and 52.8% response rate, respectively. The mean rating for the Educational Consequences composite (45.25%) was one of the only composite quality criteria that was not above a mean of 65%. The individual indicators for this composite include: the assessment program motivating learners to learn more (44 %), the assessment program not hindering learning of what is desired to be learned (39%), impacting the learning objectives of future learning experiences (49%), and incorporation of feedback on the assessment program being incorporated into future assessments (43%). No quality criteria were rated above 80%. The ranges of each composite ranged from a difference of 58 percentage points to 96

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percentage points, indicating high variability in perceptions. There were no differences in perception of the quality of the assessment program between residents and preceptors. Those who had completed residency elsewhere thought the assessment program to be more meaningful and authentic than those who had only experienced residency at UNC. Educational consequences are perceived to be greater for residents who have completed residency only at UNC versus those who have had other experiences

Conclusion: Overall, the residency assessment program at UNCH is perceived to be an effective assessment program by both residents and preceptors at UNCH. The focus of improvement in the residency assessment program should be geared towards educational consequences, and ensuring the assessment motivates learners to learn more, learn what they desire, and incorporates their feedback. Resident assessment should build upon prior experiences.

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49-T

Category: Quality Assurance / Medication Safety

Title: Scatter plot methodology in smart infusion pump library refinement to reduce clinically insignificant alerts

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Purpose: Smart infusion pumps are implemented in health systems as an approach to reduce medication administration errors. Development of the smart pump drug library upon implementation to encompass institution-specific dose and rate limits, concentrations, and clinical advisories is a complex process requiring multidisciplinary resources. Over time, refinement of dose limits is critical to reduce clinically inappropriate medication administration alerts succeeding evolving evidence based practice and possible oversight in drug library development. The purpose of this study is to evaluate and refine current smart pump drug library limits using an analytics based approach in an effort to reduce clinically insignificant alerts while maintaining safety.

Methods: A six month override alert analysis report was used to identify the top 20 overridden medications. Each respective medication was graphed using scatter plot methodology to show the number of overrides versus final programmed rate in a given time period with markers for upper and lower drug library limits. If a significant opportunity to reduce the alerted final doses programmed existed, the respective limit was evaluated using institution and evidence based practice and revised if applicable. In order to reduce clinically insignificant alerts without compromising safety, a two year alert summary report was evaluated to identify incidents of alerts that led to edits, which indicates potential programming errors may have occurred. The potential errors were considered when revising drug library limits. A drug library update encompassing revisions to the top 20 overridden medications was performed in December 2013 and 80% of the smart pumps were updated by February 2014. Investigators will generate an alert analysis report to evaluate reduction in alerts.

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Category: Quality Assurance / Medication Safety

Title: Effectiveness of labeling and storage standardization on reducing dispensing errors with solid oral medications with multiple dosage forms

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Purpose: Solid oral medications with multiple dosage forms, such as divalproex sodium delayed release and sprinkles, are frequently confused during the filling phase of the medication-use process. This is one of the most common filling errors detected by pharmacists during checking and by nurses during medication administration according to our internal data. We developed a systematic approach to labeling and storage specifically designed to prevent dispensing errors with these types of medications. We sought to determine the effectiveness of this intervention by comparing voluntarily reported error rates six months pre- and post-intervention.

Methods: We designed a standardized method to label and store solid oral medications with multiple dosage forms. We used the same storage bin used for all other medications in our pediatric pharmacy; however, the bin for these medications also had a lid. The labeling for products in our pharmacy was previously standardized but there was no special process to identify medications with multiple solid oral dosage forms. We created standardized labeling with larger font and bold letters to highlight the dosage form differences with these medications. We also added a warning sticker to the top of the bin lid indicating, warning: multiple solid oral dosage forms. We educated staff on the impending change in storage of these medications throughout the week then implemented the bins altogether on one day. We planned to review voluntarily reported error rates for these types of medications for two specific nursing units that are high utilizers of these types of medications for 6 months pre- and post-intervention.

Results: Initially forty-one medications with multiple solid oral dosage forms were identified as items stocked in our pharmacy. We choose to test our intervention with a subset of these medications, those with overlapping strengths (e.g., divalproex sodium delayed release 250 mg and divalproex sodium extended release 250 mg) and those available as orally disintegrating tablets, which appeared to be the items most commonly involved in dispensing errors from our internal data. Thus we implemented the

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new labeling and storage standards for 15 medications that accounted for 89 distinct products. From our online error reporting system, we identified voluntarily reported errors for two specific nursing units involving medications with multiple solid oral dosage forms that occurred 6 months prior to our intervention. Errors identified were classified according to drug, dosage form and error type. Average number of errors per month and per six months was identified. The same data will be compiled for the post-intervention time period, which will conclude in May 2014. Upon review of preliminary data we have seen a dramatic decrease in the number of voluntarily reported errors involving these medications.

Conclusion: There are several drugs with multiple solid oral dosage forms, many of which have overlapping strengths, which can increase the likelihood of mix-ups. Standardization of storage and labeling of medications with multiple solid oral dosage forms appears to have dramatically reduced voluntarily reported dispensing errors involving these products in our pediatric pharmacy. In the absence of more robust forms of prevention (e.g., bar-code enabled dispensing) this intervention appears to be an effective method to reduce dispensing errors with medications with solid oral dosage forms.